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STUDIES IN THE ECONOMICS OF EDUCATION

by
BRUCE W. WILKINSON

JULY
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ECONOMICS AND RESEARCH BRANCH
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⋆ Foreword ⋆

In the course of research work carried out or supported financially and in other ways by the Economics and Research Branch of the Department of Labour in the manpower and industrial relations fields, special studies of a technical and semi-technical nature are undertaken from time to time, the full results of which are not included in the regular reports issued by the Branch. Such work, however, is occasionally of a pioneering character or sometimes contains information not available elsewhere which would be useful to research workers and others interested in manpower and industrial relations problems.

This series of occasional papers or monographs will, therefore, contain the results of such special studies, which would not otherwise be distributed as a part of the regular publication program of the Branch. The papers will cover a wide range of subjects, and will be issued only as and when appropriate research work has reached the point at which publication is warranted.

The authors of these occasional papers will be exploring many aspects of their research findings. It should, therefore, be understood that the responsibility for inferences and implications is assumed by the authors and should not be interpreted as a reflection of Departmental thinking or policy.

This series is edited and prepared for publication by the Editorial Section of the Information and Labour Gazette Branch, Department of Labour.

J.P. Francis, Director,
Economics and Research Branch

⋆ Preface ⋆

This paper is based on work carried out at the Massachusetts Institute of Technology and is published here with the permission of the Institute's Department of Economics and Science.

I am grateful to Imperial Oil Limited whose financial assistance made this research possible. There are a number of persons to whom I am also indebted for their assistance throughout the course of my research. A special word of thanks must go to Professor R.S. Eckaus of the Massachusetts Institute of Technology for guidance, criticism, and encouragement that were of inestimable value to me. I am also grateful to Professor F.M. Fisher, Professor C.P. Kindleberger, and Professor C.A. Myers of the same Institute for advice on various portions of the analysis.

The National Employment Service of the Department of Labour, Canada, and the Unemployment Insurance Commission, gave their wholehearted co-operation in conducting the survey of employer order cards analyzed in Chapter 3. I am particularly grateful to L.P. McCloskey, Chief of the Analysis and Development Division of NES and to members of his staff; to Dr. F.E. Whitworth, Director of the Education Division of DBS; to Dr. Z.W. Sametz, Director of the Economic and Social Research Division, Department of Citizenship and Immigration; and to J.P. Francis, Director of the Economics and Research Branch of the Department of Labour. I should also like to acknowledge the invaluable advice and assistance given to me by the late Dr. Paul Casselman and several members of his staff in the Manpower Resources Division of the Department of Labour. Finally, I owe much to my wife, Myrna, who was a constant source of encouragement.

Bruce W. Wilkinson,
Department of Economics and
Political Science,
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⋆ Introduction ⋆

In the past two decades there has been a phenomenal acceleration in the growth of both educational enrolment and expenditure in Canada. For example, from 1943-44 to 1953-54, elementary and secondary school enrolments in Canada rose from 2,061,000 to 2,709,000, an increase of 648,000. The subsequent ten years witnessed an expansion of four times this amount, bringing total attendance up to 4,790,000.[1] Full-time university enrolments have likewise risen rapidly - from 36,000 students in the early years of the Second World War to 158,000 in 1963-64; this represents an increase of nearly 440 per cent.[2]

The percentage increases in spending have been even greater. In the twenty-year period 1943-1963, outlays for formal education rose from $218 million to $2,479 million - an expansion of 1,137 per cent in twenty years.[3]

These increases are not limited to purely academic schools and universities. Since the passing of the Technical and Vocational Training Assistance Act in December 1960, federal approval has been granted for the construction of, addition to, or alteration of 730 technical and vocational high schools, trade schools, and institutes of technology. By mid-1965, the estimated cost of these undertakings was $800 million, representing accommodation for an additional 250,000 students.[4]

The end of this mammoth expansion of facilities and expenditures is nowhere in sight. As the following table reveals, outlays for 1971, in constant 1957 dollars, are expected to be more than double their 1961-62 levels; and by 1981 they will be well over three times the magnitude of two decades before.

TABLE 1
EXPENDITURE PROJECTIONS FOR FORMAL EDUCATION
(millions of constant 1957 dollars)

Education Category	1961	1971	1981
A) Elementary and Secondary Education			
Public	1,232	2,010	3,170
Private	50	90	150
Sub-Total	1,282	2,100	3,320
B) Teacher Training Outside Universities	19	35	60
C) Higher Education	278	900	1,500
D) Vocational Training	72	300	600
TOTAL	1,651	3,335	5,480

Source: Eric J. Hanson, A Brief to the Royal Commission on Taxation submitted by The Canadian School Trustees' Association (Edmonton: The Association, 1963), Table I.

The Canadian increases in enrollments and spending, both past and anticipated, are not uncommon throughout much of the world. Accompanying these increases has been a proliferation of literature on nearly every aspect of the educational process. Such literature bears witness both to the growing appreciation of the benefits to be derived from education and training programs when these are prudently carried out, and to the serious concern regarding the magnitude of the problems which must be faced as these trends continue.

Economists have also begun to devote considerable attention to this segment of the economy which, in Canada at least, currently accounts for roughly 5 per cent of the gross national product and promises to be closer to 7 per cent ten years hence. Their interest has centered upon such questions as the relationship between education and economic growth, the proportions of nations' resources that should be assigned to education at various stages of

economic development, the types of education and training necessary for continuation and acceleration of growth, as well as the most effective and efficient ways of mobilizing and utilizing the requisite resources.

Accordingly, Chapter 1 of this paper is devoted to a review and assessment of the major avenues economists have followed in their investigations of the relationships between education and economic growth. It is hoped that this discussion will prove useful not only to economists but to other researchers and interested laymen as well.

Subsequently, in Chapter 2 the human capital investments represented by Canadian immigration and emigration are estimated. The dollar magnitudes of these movements of people relative to each other, to total educational outlays, and to other pertinent economic magnitudes are also considered.

Chapter 3 contains a discussion of two methods of determining how much and what type of education and training the Canadian labour force requires. In addition, several of the factors, which may influence the level of education that employers desire potential employees to have, are examined. Finally, conclusions are drawn regarding the merits of further research using these methods.

Throughout the two empirical chapters little attention is given to developing comprehensive public policy recommendations. Emphasis is placed instead upon the development of the techniques of investigation themselves. It is hoped that this development will assist in focusing the reader's attention on the many questions remaining unanswered and thereby stimulate much additional research in the vital area of education and its relationship to economic growth.

Footnotes

[1]Canada, Dominion Bureau of Statistics, Education Division, Survey of Elementary and Secondary Education: 1956–58 (1960), Table 17; also Preliminary Statistics of Education: 1963–64 (1964), Table 1.

[2]Ibid., Table 9.

[3]Canada, Dominion Bureau of Statistics, Education Division, Survey of Education Finance: 1959–60 (1963) p. 9; also Preliminary Statistics of Education: 1963–64 (1964), Table 21.

[4]Ross C. Ford. "Technical Vocational Education: Five Years of Increased Federal Aid", School Progress, June 1965.

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A Review of the Literature

Economists have taken a number of different approaches to analyzing the relationships between education and economic growth.

Some have argued that outlays on education should be treated wholly, or in part, as human capital formation. They have accordingly examined both the methods of calculating this capital formation and the rates-of-return from such expenditure. They see in this approach a method of determining how much should be expended on education as opposed to other capital outlays.

The concern of other economists has been to identify the critical factors responsible for economic development. They have considered education to be only one of several key variables - the importance of which they were attempting to assess. This approach differs from the first more in the breadth of its scope than in any intrinsic way.

Attempts have also been made to correlate the economic development of various countries with the educational expenditures and educational characteristics of their citizens. Similar correlations have been attempted among firms or industries. The hope has been that, through such comparisons, useful information might be obtained about the relationship between education and economic growth.

Another approach has been to take it for granted that continued economic expansion requires skilled and educated people in greater numbers. Those using this approach have also acknowledged that, for social or cultural reasons, people will want more education in the future. They have, therefore, proceeded to estimate what these economic and cultural demands will be. "Manpower

planning", as it is called, has come to hold an important place in the economic and cultural development of most countries.

With such a diversity of approaches to the economic problems presented by the recognition of education as a strategic variable in growth, it is natural that differences of opinion should arise. The purpose of this chapter is to examine and assess these approaches so that each one may be seen in clear perspective.[1] Because the main emphasis of the polemics has centered on the human capital approach, and because a subsequent chapter uses this type of analysis, it is emphasized most. No attempt is made to review the many problems that the financing of education presents, as this topic is outside the scope of the current study.

Human Capital Approach

To speak of the "human capital" approach to the economics of education is in a sense a misnomer, since all approaches to the economic problems of education use the term human capital. However, decisive differences are to be seen in the emphasis placed on this term by various writers. On the one hand it is employed in a loose way to denote an idea, an analogy with physical capital - without any intention that it should actually be handled as physical capital in the national accounts and in other respects. This view is taken by John Vaizey, Richard Eckaus, and others, who endorse the need for manpower planning in its various forms. On the other hand some economists, Gary Becker and T.W. Schultz for example, believe that human capital is the concept that has been missing from the 'box of tools' needed by the economist for a rigorous analysis of our economic system. They treat it as physical capital, and suggest that precise answers to such questions, as how much and what kind of education the economy requires, can all be resolved in this manner. It is the latter viewpoint that is emphasized in this section.

The exposition begins with an examination of the similarities and differences between human and physical capital formation. Three ways of calculating the stock of human capital in an economy and the usefulness of these methods are then reviewed. The final part of this section is devoted to a criticism of employing social rates-of-return on education as the criterion for allocating public funds to education.

Education as Investment in Human Capital

In a number of ways, expenditures on human capital formation through education are similar to outlays on physical capital. They involve the use of goods and services which could have been used for other purposes. The resulting capital yields a series of returns to the owner over future years. As with physical capital, in which new technology has been embodied, human capital directly affects the methods and efficiency of production. Also, human capital, like physical capital may be made obsolete by changes in technology.

In other respects, however, educational outlays are unlike the usual expenditures on physical capital. As Eckaus has pointed out, the process of human capital formation not only develops labour skills but finds them as well. Thus it both improves the quality and increases the quantity of talent.[2] The talent so developed can be employed not only in production of consumer goods, physical and human capital, but also in invention and innovation along scientific, technical, or administrative lines. Furthermore, human capital is likely to be more flexible in the number of different jobs it can perform than are many types of physical capital. Also, human capital is inalienable; individuals cannot sell themselves in the same way as they can sell physical capital. Even if an outsider finances a person's investment in education or training, the human capital so developed belongs to the individual receiving the education. It only becomes productive if he wills it so. While all these features distinguish the two forms of capital, they do not in themselves present any significant analytical difficulties in the use of the human capital concept.

Of more serious concern is the fact that outlays for capital are clearly investment whereas education is a consumption-good as well as an investment-good.[3] It is current consumption to the extent that the individuals receiving the education derive current pleasure from absorbing new ideas and associating with people of similar interests. Parents, too, derive current pleasure from seeing their children gain in learning and widsom. Education is also comparable to a durable consumer-good which yields a series of satisfactions to the owner over a period of years. These satisfactions may be refinements of taste in literature and the arts or broadened interests.[4,5]

How then can the investment portion of the disbursements for education be separated from the consumption portion to arrive at the quantity of human capital in existence? Eckaus[6] provides a

clear statement of this difficulty:

> A man is a man, and when he works with a spade or a machine he is also a citizen, a member of a family, a little bit of an enterpriser, and so on. The education he acquires in, and for any one role in which he functions is also applied in some degree to every other role. Put another way - the economic role of education in the preparation of skills for use in production cannot be fully separated from its consumption features.

Bowen[7] sees it as a joint-cost problem where, from the same inputs, two different end-products - occupational preparation and pleasure - are the result.

An additional problem arises with respect to housewives and mothers who may be in the labour force for a portion of the year or not at all. What part, if any, of their schooling should be considered investment?

Various approaches have been taken by economists. Some have assumed all the expenditures on education are consumption and have gone on to compute the income elasticity of demand for education. Results have varied from a low of .73 by Brazer to a high of 3.5 by Schultz.[8] This variation in answers is due to differences in the items of cost included. Brazer used only spending on current operations per capita, whereas Schultz counted all costs of formal education, including implicit depreciation, interest on investments in educational facilities and earnings foregone.

There are several weaknesses in these calculations. First, in computing income elasticity of demand, it is not essential to assume that all educational outlays are consumption. In development planning particularly, the income elasticity of demand for housing is often calculated, yet housing is normally handled as investment in national accounting systems. Secondly, since educational expenditures are governed much more by political process than are other outlays of individuals, there is much doubt about the accuracy and predictive value of such estimates. Finally, Schultz in his estimates has evidently omitted to take into account that earnings foregone must be included not only as an outlay on education but also on the income side.

Another approach to the investment-consumption problem of educational outlays has been to make some arbitrary division of expenditures into the two categories. One such way is to assume

that all educational outlays on secondary schooling and beyond are investment and that primary schooling is consumption. However, this method ignores that for a person to absorb secondary and higher education he must have had primary schooling. Also, it would be incorrect to treat all those with only primary schooling as representing no education investment.

A third and more appropriate approach is to count all educational outlays as investment. It assumes that all training and education received by individuals contributes directly or indirectly to their actual or potential productivity. It also assumes that every person is a potential member of the labour force and represents an investment in human capital. This method therefore provides a maximum capital value. Then, if in any such calculations detailed figures are provided for each level of education and for women and children separately,[9] the reader can always determine the results of eliminating any one of these items from the computations. This procedure is not entirely satisfactory but it is to be hoped that as more becomes known about the purposes for which people obtain education and the contribution to productivity which various subjects make, a less arbitrary method might be possible. However, such knowledge appears to be some distance away at present, and in the meantime there is no reason to deprive ourselves of the usefulness of at least crude estimates of the value of human capital such as this approach provides.[10]

Measures of the Capital Value of Trained and Educated People

Three methods have been used to measure the capital value of the education vested in individuals. The first and simplest of these is to calculate the years of education represented by the populace. The second involves computing the production or replacement costs of educated people. The third is to estimate the discounted values of individuals' anticipated future earnings.

Years of Schooling. Estimates of the level of productive skill in a country by the years of schooling possessed by the population or labour force may be made in two ways. The crudest method is to total up the years of education in the economy without distinguishing between levels of schooling. Such a figure has no more meaning than does a numerical inventory of machines without regard to their size or cost. This approach is clearly worth little.

A more refined technique involves determining the average levels of education of the various occupational groups and of the entire work force. Vaizey[11] advocates this method because of its simplicity and because he feels that it provides all the information necessary for inter-country or inter-temporal comparisons of labour force composition. Such comparisons, he seems to feel, are the only purposes of having estimates of the education levels of the labour force.

However, two points should be noted. First, as will be indicated later in this chapter, inter-temporal and inter-country comparisons are not very useful guides in determining educational policy. Secondly, Vaizey, in endorsing this approach, appears to ignore the existence of other potential uses of human capital estimates that are not possible if only estimates of years of education are available. Some measure of the dollar value of the education and training invested in people is often essential. Let us therefore turn to the second method of measuring the amount of human capital represented by a trained and educated populace.

Costs of Production or Replacement. There are two basic ways of calculating the dollar costs of educated human capital. These are comparable to the two methods normally used for estimating the value of physical capital. The first is to price the capital (physical or human) at the cost of the resources used in the year or years when production occurs (the cost-of-production method); the second is to use the cost of the resources that would be required to replace the capital at present (the replacement-cost approach). As in the evaluation of physical capital, the choice as to which of these methods should be employed in evaluating human capital will depend upon the purpose for which the results are going to be used and the availability of data. This problem of choice has received attention in accounting literature and will not be entered into here.

The major economic questions raised with respect to this approach have centred on the items of cost to be included in estimating dollar values. We shall therefore examine the various possible cost items and assess whether they should be admitted.

The one educational expense over which there has probably been more debate than any other is foregone earnings. There are two questions to be considered. First, should these foregone earnings be included in estimates of human capital? Second, what value is to be placed on them if they are included?

The answer to the first query becomes evident when we consider that these foregone earnings represent the income the individual could have received if he were not attending school. To him, they are the opportunity-cost of school attendance. They also represent the loss in output that society suffers because he is not in the labour force. Therefore, from the viewpoint of both the individual and society, there is good reason to include foregone earnings when estimating the value of the education vested in the populace.[12] The magnitude of these, in relation to other education costs, make it essential that they are not neglected: one estimate for the United States places their value at three-fifths of the total cost of education.[13]

Recognition of foregone earnings is also imperative for other reasons than merely achieving more accurate estimates of the stock of human capital. It helps us to understand why many young people of low-income families or in low-income countries do not continue their studies even though tuition is free. Their parents simply may not be able to finance them while they are in school and the children have to assist in supporting the family. This suggests that, if in the future, we want to encourage students from poorer families to attend high school - let alone university - we will almost certainly have to provide many more fellowships than are presently available. These fellowships may have to be sufficient to cover not just tuition and books but, more important, the opportunity-costs of school attendance as well. Even John Vaizey,[14] who is probably the strongest opponent of the foregone-earnings concept, recognizes that in poor countries if education is to be extended to more young people it will "entail a policy of family support".

A more difficult problem is what value should be assigned to foregone earnings? The basic computation appears simple enough. To estimate the opportunity cost of attending high school, for example, one would determine the average earnings of young people of high-school age in the labour force and adjust this figure downward to allow for the unemployment rate. The difference between this figure and the average summer or part-time earnings of students in high school would be the opportunity-cost of attending high school.[15]

Several problems are ignored, however, in this simple calculation. Is it correct, for example, to assume that the average earnings of young people in the work force are an accurate estimate of the income that young people of similar age attending school are foregoing by not being in the labour force? Some have argued that those remaining with their studies have greater perseverance

and ability and would therefore earn more if they were in the labour force. Thus opportunity-costs as calculated here would be underestimated.[16] On the other hand, it can be argued that the marginal productivity of labour would be diminished if some of those in school entered the labour force. From this viewpoint, the foregone earnings would be overstated. At present there is no way of knowing the extent to which these two possibilities offset one another. However, they should at least be kept in mind when working with estimates of foregone earnings.

A more serious overstatement of the opportunity-costs of school attendance would result from the above approach if there were a major, rapid shift of young people from school to the labour force. Wholesale unemployment would result and marginal analysis would no longer be applicable.[17] The true opportunity-costs of remaining in school would be negligible. Machlup[18] waves this problem aside on the grounds that "there is no question of actual transfer, either sudden or gradual, from school to the labour market". A more accurate statement would be that even if it did occur, government policy would be directed at eliminating the resulting, massive unemployment; the experience of the 1930's is not likely to be repeated. Consequently, the probability that true opportunity-costs of remaining in school are zero (or close to zero) is very small.

Another difficulty that arises with this simple calculation of foregone earnings is that it does not express the full loss to society of persons remaining out of the labour force. As Eckaus[19] has indicated, it ignores the possible increase in national income that might have resulted if individuals had been earning income and investing a portion of it. This is a good point; if costs of education are being compared over time so that changes in spending-saving patterns could significantly influence the value of this component, then some estimate of its magnitude should be attempted. However, when computing replacement costs of education at a given point in time, such as is done in the following chapter, this factor is of less importance. Where one is dealing with costs of and returns from extra education to the individual, not only should the present value of income from savings out of foregone earnings be included as a cost, but also the extra income on savings out of higher incomes - resulting from more education - should be considered as a return on that education. Unfortunately, there is as yet no reliable method of estimating these costs and returns. The best possible approach may be to calculate the present values of annuities purchased with the savings from the foregone earnings on the one hand, and the higher income from additional education on the other. Such annuities would have present values greater than

the present value of the savings themselves if their yield rates were greater than the discount rates used. The results would therefore depend upon the assumptions made regarding yield rates and discount rates. Any number of different answers could be obtained from such calculations. The reader will also see that the simple calculations of foregone earnings, as suggested at the beginning of this discussion, can only be regarded as a first approximation of the "correct" value of this item of cost.

A different approach to the figures of foregone earnings was used by Peter Wiles[20] in his estimates of costs of education in the United Kingdom. He estimated a maintenance charge for the opportunity-cost of students remaining in school. Normal costs of living, which apply whether persons are in school or not, should not be considered as additional educational costs. However, the idea of using them as a substitute for other estimates of foregone earnings may not be altogether without merit if no better figures are available. Schultz's rejection of this approach appears to miss this point.[21]

A final difficulty in estimating foregone earnings occurs with respect to women remaining out of the labour force to care for children of pre-school age. Should the value of the income they are losing by remaining at home be considered as part of the cost of educating the children? Furthermore, should high foregone earnings be assumed for those women with more education? These problems resemble those of whether housewives' services should be given an imputed value in the national accounts and what values should be placed on them. There are no easy solutions to these difficulties. The general practice, however, has been to exclude housewives' services from calculations of the capital value of the education embodied in humans.[22] Although this is a somewhat arbitrary decision, at least it has the merit of being consistent with the method used in handling housewives' services in the national accounts.[23]

Two other major cost items that have been the subject of some disagreement among economists are outlays for plant and equipment. The most reasonable method of handling these costs (and the one we shall use in the next chapter) is that developed by Schultz.[24] He deducted capital expenditures from aggregate outlays on formal education, then computed implicit interest and depreciation upon the stock of physical capital existing in subsequent years. For comparison of annual education costs per student, this procedure gives a more reasonable set of results than the standard fiscal procedures. In the fiscal approach, when the costs of education are determined for any one year, all new

capital and current expenditures are included. This means that, in years when capital spending is high, educational costs per student would be high. When capital spending is low, educational costs per student would be low. The Schultz method avoids the possibility of these wide annual fluctuations in costs per student by distributing the capital value of physical facilities over their useful life through depreciation allowances.

Essentially, Vaizey[25] used the fiscal procedure in his study of education costs in the United Kingdom. However, his private school costs estimates are based on fees which one assumes would be at a level such as would cover depreciation and interest. Thus, his method for private schools is not unlike that of Schultz.

Blitz[26] uses Schultz's approach to arrive at implicit interest and depreciation, but then adds on the total costs of capital outlays on plant and equipment in the years they were made. This is obviously double counting. Machlup[27] defends the approach on the grounds that, "an analysis of resource allocation requires the consideration of the opportunity-cost of every activity". But a analogy to business practice reveals the error in this approach: a company deciding between two investment alternatives involving the same amount of capital could treat the lower return to be gained from the less favourable investment as the opportunity-cost of the better project. An investment theorist would frown upon this highly over-simplified statement but, without reviewing the finer points of investment decisions, it is sufficient to observe that the entire cost of the alternative undertaking would not be considered as an additional expense of the project chosen. Consequently, there is no reason why a special double counting procedure should be followed for educational outlays, particularly when the total of those outlays is to be compared in size to the stock of physical capital.

It is possible that Schultz's assumption of a 5.1 per cent interest rate may be too low to reflect accurately the opportunity-cost of expenditure upon educational facilities, but it would seem better practice to raise this rate rather than follow Blitz's procedure. Furthermore, it is by no means clear that the rate should be increased for there is no final answer in the literature on what discount rate should be used in deciding upon government projects.[28]

Another conceivable cost of education is the value of services rendered free of charge to schools and colleges by governments. Blitz makes provision for them using estimates of property and sales taxes (from which educational institutions are

exempt) as the cost involved. At best this is a dubious procedure. If government services to educational institutions are "pure public services" in the sense that one person may enjoy them without reducing anyone else's consumption of them, the marginal cost of providing these services is zero. Police and fire protection could be considered in this category, since it would be difficult to argue that either service would have to be enlarged just because there is a school in the area. Even where marginal costs are not zero, imputed property or sales taxes are not likely to be a very good estimate of the true costs. In fact, there is no known way of separating out the value of those public services to educational institutions. Normally, no attempt is made to include them in estimating total costs of education vested in individuals.

There are several other potential costs which should be indicated. Teachers' salaries are a legitimate cost of education and present no problem. So are outlays for books, additional travel to and from school, and extra clothing. However, normal expenditures for food, clothing, shelter, and recreation should not be included as they have to be borne anyway whether a person is in school or not.[29] Fellowships should not be counted either as these are, in effect, a payment for foregone earnings that are already included.

In summary then, the costs to be considered when estimating human capital values based on either the cost-of-production or replacement-value approaches include foregone earnings, cost of instructors, current outlays for operation of physical plant and equipment (including depreciation and implicit interest on the value of the physical assets), and incidental expenses of schooling such as books and extra travel. It should be pointed out that these cost items, when aggregated, give the value of the education vested in individuals from society's viewpoint. If one were estimating costs from the individual's viewpoint, tuition charges would replace the allowances for teachers' salaries and operating costs of the physical plant.

A final problem that should be mentioned is what allowance, if any, to make for depreciation of the human capital values due to either obsolescence of skills or aging. The discussion of this question will be deferred, however, until later in this chapter when manpower planning models are examined.

A major advantage of estimating human capital values in terms of production or replacement costs is that the same methods are used in the valuation of the stock of physical capital. Consequently, comparisons of the magnitude of the two types of capital

or the annual investments in each are easily made. To illustrate, Schultz[30] found that for the United States the total annual outlay for human capital (in terms of primary, secondary, and higher education expenditures) rose from 9 per cent of the annual investment in physical capital in 1900 to 34 per cent in 1956.

Furthermore, the trend in the total capital-output ratio for the United States is quite different when human capital estimates are added to the totals for physical capital. Instead of declining, it holds roughly constant for the period 1929-1957.[31] In the same vein, Harry Johnson[32] has pointed out that the problems of "...reconciling the accumulation of capital with the growth of the labour force at a different, autonomously determined rate, and explaining the constancy of the share of labour which apparently results from the growth process...present an altogether different appearance once labour as well as capital equipment is recognized as a medium of investment".

Also, when estimating the actual or potential productive capacity of nations, knowledge of the availability of both physical and human capital, calculated and expressed in the same manner, is useful. A good example of where a substantial stock of human capital required only physical capital for productive capacity to be restored and enlarged is that of war-demolished Europe. In contrast, the less-developed nations need not only physical capital but also vast expenditures of human capital if their productive capacity is to be expanded.

The dollar value of immigration and emigration for a nation can also be estimated and compared with other dollar magnitudes in the economy. This application is developed more fully in the next chapter.

We now turn to examine the third approach to calculating human capital values. This method involves estimating the discounted values of peoples' future earnings.

Discounted Value of Future Earnings. Essentially, this approach involves discounting to the present the anticipated net lifetime incomes of individuals. The higher the discount rate used, the lower will be the present value of the lifetime earnings; that is, the lower will be the value of the stock of human capital. A number of variations in this method have been used. For example, Burton Weisbrod[33] estimated the gross production of a man as a function of the value of the man's annual output, labour force participation rates, and the probability of survival. He assumed an unemployment rate of 5 per cent and to arrive at net figures

deducted peoples' estimated consumption. Using discount rates of 4 per cent and 10 per cent he found that the maximum capital-value of man occurs at age 27 if the first rate was employed, and at age 30 if the second was used. For people over age 70, negative values resulted.

Renshaw[34] calculated the stock of human capital by capitalizing median income differentials and discounting at both 5 per cent and 10 per cent. He found that his results fell one on each side of Schultz's cost-of-production estimates of human capital values for the United States.

Employing a more sophisticated approach, Gary Becker[35] has developed a general model of investment in human capital. Although he uses on-the-job training in the model, he demonstrates how his method can be applied to all forms of human capital formation; in doing so his analysis assumes two types of training; general and specific.

General training is defined as being useful not only in the firm providing it but in other firms as well; that is, the marginal product of workers is increased wherever the employee works. He theorizes that the firm, by extending its training operation, will also have to raise wages in proportion to the marginal productivity of workers in order to keep them on its payroll. Since the firm cannot recover the costs of training by offering subsequent wages that are lower than the marginal product, employees must absorb the cost of such general training by receiving wages, whilst in training, that are below their marginal product.

Specific training is that which raises the productivity of employees only in the firm providing the training. This can either be paid for by the firm, which recovers its outlay by deducting from future wages, or the employee may bear the cost - providing he feels that there is little likelihood of being fired after completion of training. In general, a firm is more likely to pay for the training and then offer the employee an income sufficient to encourage him to stay, although this could be somewhat lower than his increased marginal product warrants.

Becker uses his model to explain phenomena such as: (a) why employees, who have received specific training paid for by the firm, will be less likely to be laid off in temporary slack periods; (b) the steepness of the age-earnings profile; and (c) the inter-personal and inter-area differences in earnings. He also

argues that rates-of-return, total investment in schooling, on-the-job training, and the period over which investment occurs can all be derived from data on net earnings alone.

There are, however, a number of weaknesses in his analysis that should be noted. He relies on the assumption of perfect competition, which is highly unrealistic. Observed differences in occupational wage streams may reflect merely the degree of imperfection in the labour markets, not differences in the amount of investment in human beings. Also, he appears to ignore the fact that on-the-job training is of necessity a joint product with firms' other products. In most cases, therefore, it is impossible for a firm to determine what the training costs actually are and what portion of these costs it should bear.[36]

Furthermore, with respect to his derivation of rates-of-return, total investment, and the period of investment from data on net earnings, the assumptions he makes are highly restrictive. The first is that in the base-level activity (which he considers as the work of an unskilled labourer) no additional learning occurs beyond the work-starting age. Second, any returns obtained by this type of worker are assumed to result from investment in schooling before the starting age. Third, some rate-of-return from this initial schooling must be hypothesized. Finally, the rate-of-return computed by Becker is an average rate which implies an assumption that the rate is identical for each year and type of investment in schooling or on-the-job training.

Jacob Mincer[37] employed Becker's method and estimated the total value of on-the-job training costs for United States males in 1939, 1949 and 1958, by levels of schooling. However, the results, like the assumptions needed to achieve them, are open to question. To illustrate, one finding by Mincer was that "...the opportunity-costs of on-the-job training per male are almost without exception somewhat higher than costs of a comparable increment of schooling".[38] If businesses do not know the costs of training their employees, it is difficult to believe that they would reduce wages offered at all, let alone by so much that opportunity-costs for employees receiving training are greater than the losses that would have been suffered had they remained in school! Even where firms have reasonably accurate data on the costs of training - as may be the case where executives are enrolled at company expense in advanced-management courses - there is no evidence to indicate that the earnings of these men are below what they might be receiving if they were not in training programs. Moreover, it is certainly not general practice to reduce the salaries of men when they commence such courses. In the majority of cases, then,

firms' training-costs, even where known, are treated as expenses and not charged to workers. Consequently, it appears that calculations of the opportunity-costs and hence the investment in on-the-job training are of doubtful worth.

Apart from these specific criticisms of the Becker-Mincer approach, there is some question as to the general usefulness of capital values obtained by the discounting technique. For one thing, estimates of physical capital and of the other magnitudes in the national accounts are based on selling (or cost) prices, not at the value of discounted earnings.[39] Consequently, the production or replacement cost approach to human capital values provides dollar figures more comparable to physical capital values than do discounted earnings.

Secondly, variations from year to year in demands for people with varying amounts and types of schooling would alter present and future relative incomes of occupational groups and, hence individual and total discounted values. This is perhaps as it should be, providing that the alterations in incomes reflect the interplay of free market forces. Frequently, however, such shifts in value would indicate nothing more than changes in bargaining power by unions, management, or even professional associations, not to mention political pressures and any number of other causes of market imperfections. Consequently, for this reason as well, the approach may not give dollar values reliable enough to make comparisons with physical capital values and other items in the national accounts or balance of international payments.

In some instances, however, capital values arrived at by discounting future incomes (and considering individuals' consumption) may be of some value. Weisbrod,[40] for example, demonstrates that with such figures the contrast in the economic value of both new babies and the prolongation of life between such countries as the United States and India can be clearly seen. In the United States, because net returns from individuals are positive up to about age 70, both new babies and extension of life (at least to age 70) result in a net gain to the economy. In India, on the other hand, if marginal productivity is zero, these items each have negative effects upon output net of consumption because people would be consuming but not contributing to production.

Private Rates-of-Return. A related application of the discounting technique has been to estimate private rates-of-return to investment in various amounts and types of education. These are the net returns the individual may expect to receive by "investing" in his own schooling. The calculation essentially

involves determining that rate of discount which, when applied to the net stream of revenues expected from a particular level of education or occupation, will cause the present value of this stream to equal zero. The "net stream of revenues" is defined as expected income less the costs of the schooling.

The costs of schooling are normally incurred in the initial years of the time-horizon and include tuition, foregone earnings, and incidental costs such as books and extra travel expenses.

A pioneering work in this field was that by J. R. Walsh in 1935.[41] He calculated the net discounted lifetime earnings for high school students, B. A.'s and several professional occupations involving additional university training. From his results he drew conclusions about the nature of the equilibrium in the labour markets for these types of personnel. Ten years later Friedman and Kuznets[42] examined the discounted capital values of the net earnings from several occupations; their main interest was in explaining income differentials. Houthakker[43] has also calculated discounted values for persons with various amounts of schooling using several discount rates. More recently, Becker[44] has examined private rates-of-return for 1939 and 1949 on different amounts of education and for several types of people in the United States economy. He estimates that the return to an average college entrant is of the order of 10 or 12 per cent per year. The rate for urban, white, male college graduates is higher than this, whereas for college drop-outs, nonwhites, women and rural persons it is lower.

The potential usefulness of such calculations has not yet been fully explored. It may be possible that people are making this type of calculation (although implicitly) when deciding whether to remain in school or not and what occupation to take up. Governments in turn may be able to take advantage of this type of behaviour. First, they might compute and disseminate information on the private rates-of-return or the estimated net private discounted values of various occupations, so that individuals could be better informed about the monetary gains from different occupations and levels of schooling. Second, governments might determine the extent of peoples' response to changes in net discounted values of lifetime earnings (or rates-of-return) and then use this knowledge in applying incentives to direct individuals into various occupations according to what the future needs of the economy are expected to be (as determined by some form of manpower forecasting).[45]

There are, of course, difficulties in making estimates of net discounted lifetime earnings which can be employed for these purposes. For example, as yet we have data only on the earnings

of persons in different age cohorts. We do not know the actual lifetime earnings of persons with varying amounts of education in different occupations. Consequently, we have to assume that the available cross-section figures provide a reasonable approximation of the lifetime income which may be expected by an individual entering the labour force with a specified amount of education.

Moreover, we do not know the extent to which the observed higher incomes associated with additional education are due to the extra education, or whether they are the result of a greater ability on the part of persons with higher education, or are attributable to such influences as family wealth and connections of those who obtain more education. Several attempts have been made to isolate the effect on education of these other factors.[46] Although the results are promising, conclusive answers have not yet been found. Indications are, however, that these influences explain only a minor portion of the differences in returns. Education is the over-riding determinant.

Some economists have argued that by comparing the net returns on different occupations we would be able to determine how efficiently resources were being allocated among such occupations. A typical statement of this position is: "If rates-of-return to educational investment and to teacher investment fall below alternative rates of return, then from an economic point of view clearly scarce resources are being misallocated".[47] This is extremely doubtful. In Canada, for example, if one accepted this argument, one would assume that, because the returns to teachers are below those of engineers with an equivalent amount of education, we should cease training teachers and produce more engineers.

What the adherents to this position frequently ignore is that perfect competition in labour markets does not exist. All workers are not paid for their marginal products. Many well-known factors prevent a perfectly competitive situation from existing: monopolies, monopsonies, tradition-based wage-salary relationships, and status or seniority rules not based on productivity considerations. Therefore, if the rate-of-return is higher for engineers than teachers, it does not necessarily mean that we should reduce the number of teachers being trained. Perhaps it may only mean that teachers' salaries are still being determined by tradition, or that school boards exert a monopsonistic influence - to mention just two possibilities. Consequently, for this reason alone, rates-of-return computations make doubtful guides for resource allocation.[48]

In addition, however, there may be private non-pecuniary costs of or returns to education, which should be considered in dollar terms. Possible returns may include the option to obtain additional education, the advantages of a wider choice of jobs and the related patterns of income, living, leisure, and security. One might also allow for the cultural benefits of education to the individual such as increased ability to appreciate literature and the other arts.[49] Rates-of-return estimates which exclude such benefits are incomplete. Yet any dollar figures assigned to the value of these items are largely speculative and must be based more on value judgements than economic analysis. Hence for this reason too private rates-of-return calculations are by no means wholly satisfactory guides to resource allocation.

So far, the discussion has been about private returns to education, that is, returns which the individual may himself receive. One must also consider social returns to education, that is to say the returns which society as a whole might reap from investment in the education of its populace. It has been argued that social returns from investment in education might be compared with social returns from other public (or private) investments. Then, on the basis of the comparisons, the total quantity of resources to be devoted to education in the future and the types of educated people that should be produced could be determined.[50] This is not only the most ambitious claim advocated by the protagonists of the human capital approach to education, it is also the one that is most open to question. The claim itself, and its weaknesses, will be considered in the following section.

Social Rates-of-Return on Investment in Education

With the exception of two features, the computations for social rates-of-return are basically the same as for private rates. First, teachers' salaries and current expenditures for operation of physical plant and equipment (which include depreciation and implicit interest on the value of the physical assets) are counted as cost items in place of tuition. Second, on the revenue side, allowance must be made for the benefits to society of having a well-educated populace. These benefits may be classified into two types: those resulting from the "advancement of knowledge", and non-pecuniary benefits.

Becker's analysis[51] will be examined as an illustration of the nature of these calculations and of the difficulties encountered in attempting to develop resource allocation policies from them.

As a minimum measure of social gains from education, Becker uses the before-tax income of individuals. The resulting social rates-of-return, unadjusted for ability, for the 1939 and 1949 cohorts of male college graduates (urban, native, white) were 13 and 12.5 per cent respectively. To allow for external economic effects due to the "advancement of knowledge" beyond the value of personal income taxes included in these figures, he employs Denison's "residual" as an estimate. He assumes that the contribution of the various levels of education to the advance in knowledge are roughly in proportion to their direct influence on earnings and arrives at a social rate-of-return on white male college graduates of nearly 25 per cent. Thus he has upper and lower boundaries for social rates-of-return on education of 25 and 13 per cent respectively - the discrepancy between the two percentages being an indication of our lack of knowledge about external effects.

To obtain an estimate of the social returns on investment in physical capital, Becker accepts Stigler's figures for average after-tax returns of corporate manufacturing (7 per cent), and adds back all direct taxes; the resulting rate-of-return is 12 per cent for the period 1938-1957. Making some minor adjustments for lower returns to unincorporated firms on the one hand and for lower returns to college drop-outs, women, and non-whites on the other, he concludes that minimum business returns are roughly the same as minimum social returns on education. If the "advancement in knowledge" is attributed entirely to education, then the return on higher education is about double that on business capital. If it is ascribed wholly to business capital, the reverse is true. Thus, he concludes that "Ignorance about the 'residual', ...precludes at present any firm judgement about the relative social rates on business capital and college education."[52]

However, this is not the only difficulty. The above returns on manufacturing investment were average, not marginal. Eckaus and Lefeber have estimated the marginal rate-of-return over cost for United States investment, before tax, for the ten years commencing 1947, at over 20 per cent.[53] If this figure is roughly correct, then the minimum returns on business investment are considerably above the minimum returns on educational outlays (i.e., excluding the residual from both estimates). It is true that the educational investment figures are average returns, not marginal as they should be; but the marginal yields on education would have to be nearly double the average returns indicated above in order to approximate the marginal yields on business capital. There is no evidence that this has been so.

It should, of course, be noted that since educational institutions are frequently not profit maximizers, it is quite conceivable that there were some projects not undertaken which might have had potential marginal yields of as much as 50 per cent.[54] However, this statement cuts two ways. It can be interpreted to mean that one should not consider reducing the flow of funds to educational projects when rates-of-return on such projects fall below comparable rates on business investment. It can also be presented as a good reason why rates-of-return analysis is a unreliable method of determining the quantity of resources to be devoted to education. Because of the theoretical difficulties previously outlined, and several other reasons to be presented, the second view appears to be the best one.

Up to this point, only the economic benefits that may accrue to society from investment in education have been considered. A number of non-pecuniary advantages of education are frequently cited as well. These include a more intelligent electorate, a greater civic pride, increased sense of civic responsibility and so on.[55]

These non-monetary gains of extra education may be handled in several ways. Monetary tags may be attached to them with the result that the returns to educational investments would soar. Alternatively, that portion of the outlay on education which gives rise to such benefits may be treated as consumption spending. Then, the investment component having been lowered considerably, the true monetary yield from this component would again produce an extraordinarily high rate-of-return, greater perhaps than any rate which physical capital investment might normally be expected to render. Another possibility is to assume that a large portion of the taxes gathered to finance school expenditures as well as individual outlays for schooling come out of consumption rather than investment.[56] If this is true, then because such investment in education is not competitive with other investments for individuals' funds, the returns could be extremely low - much lower than on investments in physical capital - and yet make a positive contribution to economic growth and therefore be justified.

Using any of these techniques, increasing intensity of education for the populace could be justified up to almost any amount of education. The difficulty is that such techniques are not usable in any rigorous fashion. There is no satisfactory method of assigning monetary values to items which are largely subjective by nature. Nor is there any reasonable way of determining what portion of educational spending is investment, or what portion of taxes comes out of consumption.

Educational and expenditures are increasing in most countries; the popular demand is for more education for everyone. Consequently, there is undoubtedly a desire when calculating rates-of-return on education to obtain rates which indicate these expenditures are justified. Where the rates so obtained are lower than are required to support these outlays on purely pecuniary, economic grounds, there is a temptation to fall back on the non-pecuniary and cultural benefits - even without assigning them values - in order to tip the scales in the other direction.

In short, one can use social rates-of-return analysis to prove anything one wants to. To justify more educational spending, one can add in more non-monetary benefits or assume only a portion of the total outlays will be investment. Either technique raises the yield on educational investment. If one assumes that a portion of the tax money spent on schools comes from individuals' consumption expenditures, then even an extremely low yield rate on the investment in education justifies the outlay, because it will still be above the zero rate from consumption expenditures. To justify decreasing expenditures on education, the opposite position is taken on these matters. Any technique of economic analysis which can be twisted in such fashion to justify whatever action one wishes to take should be suspect.

In general, then, we must conclude that further research along the lines of social rates-of-return as a method of efficiently allocating resources to and among educational projects appears unwarranted.

The Residual Approach

A number of studies have been undertaken in an attempt to identify the major determinants of economic growth. Education has been suggested as one of the key variables involved.

One standard procedure has been to calculate input series for labour and capital, combine them as either an arithmetic or geometric index of inputs (using the relative income shares of labour and capital as weights) and compare their rates of increase with the rate of increase of total output.[57] The rise in total output which cannot be accounted for by the increase in inputs has been called the residual or unexplained third factor. For example, Kendrick found that of a 3.5 per cent per year rate of growth of output in the United States, only 1.9 per cent could be explained by the increase in inputs, leaving 1.6 per cent attributable to the

residual or "total factor productivity". Using the assumptions of a first-degree homogeneous production function and disembodied technological change, Solow estimated the residual to be 87 per cent of the rise in product per man hour from 1915 to 1955.

To discuss all the variations in this approach is outside the scope of this paper.[58] What is significant for present purposes is the presumption in these studies that education, through its effect both in raising the quality of the lower force and advancing knowledge, may well account for a sizable portion of the residual. This presumption has been made explicit in the recent work by Edward Denison.[59]

Building upon the foundations laid by earlier authors, he goes beyond them by subdividing the residual into a number of its component parts. In his study, additional education, through its effect upon improving the quality of the work force, accounts for 23 per cent of the positive contribution to economic growth. This figure rests on the assumption that 60 per cent of the observed differences in income between adult males of equal age are due to education; the remaining 40 per cent is deemed to reflect differences in ability. Where only 50 per cent of the income differences among people are assumed to be due to schooling, education accounts for 19 per cent of the growth. And if 67 per cent is substituted, education is responsible for 26 per cent of total expansion in output. He predicts that the rate of improvement in the average quality of the labour force due to education will be lower in the future than it has been in the past twenty years. His reason is that already a good deal of the benefit possible from raising the average education of the labour force has been achieved.

Denison attributes an additional 20 per cent of the total positive sources of growth to the "advance of knowledge". This subdivision includes what he calls technological knowledge concerning physical characteristics of things and how to use or make them and managerial knowledge. He makes no attempt to say authoritatively what the breakdown between these two items may be, but on the principle of minimizing the possible error when ignorance is complete, he suggests that an equal division may have some justification.

Denison's work has been criticized on a number of points. Lundberg[60] considered that its reliance upon the marginal productivity theory as a comparative static approach to a dynamic situation and its neglect of the demand side, were serious weaknesses. Doubts have also been expressed regarding the mechanics of some of Denison's computations. A case in point is Malinvaud's concern

that, although Denison assumes that a reduction in hours of labour is offset in part by increased quality of labour resulting from the shorter hours, he nevertheless assumes that the increase in the number of hours spent on education by individuals will be reflected in a proportionate increase in the quality of labour.[61] A less than proportionate rise may have been a more appropriate assumption. Sandee[62] takes issue with Denison because the latter assumes that technological progress is separate from rather than embodied in new capital.

More significantly, Denison's analysis does not offer much guidance on what quantity of resources should be devoted to education in the future or what types of education should be encouraged most. His estimates on the contribution to growth of education were based upon a pure assumption about the amounts of the observed differences in income due to ability and to schooling. Consequently at this stage it may be inadvisable to depend on his results in determining future allocation of funds to education.

There is, however, considerable agreement that Denison's over all analysis represents a major contribution and that his approach deserves further investigation.[63] He has clarified many of the important and even not-so-important sources of economic growth as well as the issues surrounding these items: in this sense he has provided an excellent blueprint for further investigation along these lines.[64]

International, Inter-temporal, and Inter-industry Comparisons

International and Inter-temporal Comparisons

A number of comparisons have been made among countries of educational expenditures, labour force education levels, and enrollment ratios in relation to GNP per capita. Similar comparisons have been undertaken for individual countries over time.

An early inter-temporal study for the United States was that undertaken by Seymour Harris.[65] This involved a comparison of the number of enrollments in public, secondary, and higher education with real income per capita. He suggested that once a reasonable standard of living is reached, the percentage of the population of primary school age that is actually in school begins to reach a plateau, as occurred in the United States about the turn of the century. However, during the 1930's, the proportion in

secondary schools continued to increase rather than decline as might have been expected in view of the depressed situation. He attributed this largely to the high unemployment which made the opportunity costs of staying in school almost negligible.

Another inter-temporal study by John Vaizey[66] of costs of education in the United Kingdom disclosed that the shares in total expenditure of education (as well as other social outlays) remained quite constant for 1911, 1922, 1931 and 1951.

The wish to establish in more concrete terms the relationship between income per capita and expenditures on education has led some to calculate income elasticity of demand for education. The results of several studies of this type have been cited earlier.[67]

Of the various studies that have attempted to relate the extent of economic (and political) development of countries to levels and characteristics of their educational systems, the most recent and comprehensive has been produced by Charles Myers and Frederick Harbison.[68]

Based on the data that were available for international comparisons, they employed fourteen different types of indicators of human resource development. Among these was a composite index consisting of the "...arithmetic total of (1) enrollment at second level of education as a percentage of the age group 15 to 19, adjusted for length of schooling, and (2) enrollment at the third level of education as a percentage of the age group, multiplied by a weight of 5."[69] The weight for higher education was employed to reflect the greater importance of advanced education as industrial development proceeds. Using this index, the 75 countries in their sample were classified into four categories: underdeveloped, partially developed, semi-advanced, and advanced.

A correlation coefficient matrix was computed for all fourteen indicators covering the 75 countries as a group. A high positive correlation (.89) was found between the composite index and GNP per capita (expressed in United States dollars), while a high negative correlation (-.81) was observed between this index and the percentage of the labour force engaged in agriculture.

These findings agree to a large extent with those of Svennilson, Edding and Elvin,[70] who also observed that when GNP per capita was low, enrollments in school were generally low. It should be noted, however, almost as an axiom, that when GNP per capita is low, the percentage of the labour force engaged in

agriculture will be high, so that a negative correlation will occur between the percentage of workers in agriculture and school enrollments. Thus, Myers and Harbison perhaps place undue emphasis upon the significance of the correlation between GNP per capita, the work force in agriculture, and their composite index of human resource development. In fact, the high correlation between GNP per capita and this index suggests that it might have been simpler to use just GNP per capita itself as a rough method of ranking countries for purposes of discussing their problems and needs for human resource development.

Another weakness in these correlations - which the authors themselves recognize - is that high correlations do not indicate casual relationships or the direction of causality if such relationships do exist. These correlations tell only that when GNP per capita rises and the percentage of workers in agriculture declines, there is a high probability that school enrollments will also rise. For development planning purposes, such information is too vague. Other methods must be employed to obtain the detailed information required.

Myers and Harbison did not find any consistent relationship between the percentages of college-level students in scientific and technical fields and either GNP per capita or any of their other various indicators of human resource development. The percentage enrolled in these fields in the underdeveloped countries was almost the same as in the advanced nations. This suggests that inter-country comparisons of enrollments in various faculties may not be a particularly useful way for an individual country to decide upon the proportion of its resources to be devoted to scientific and technical education.

With few exceptions, no significant correlations occurred between public expenditures on education as a percentage of national income and the other human-resource-development-indicators used by the above authors. For example, neither their composite index nor GNP per capita were significantly related to public educational outlays.

These results are not unlike those which Martin and Lewis obtained in a study comparing sources of revenue and the distribution of public expenditures for sixteen countries during 1953-54.[71] Martin and Lewis observed wide differences in the percentage of GNP going for current expenditure on education. For India and Nigeria, the percentages were .77 and .78 respectively, whereas for the even poorer nations of Tanganyika and Uganda the corresponding figures were 1.70 and 2.39 per cent - close to the percentage spent by United States of 2.40!

On the other hand, in their study on 22 countries, Svennilson, Edding, and Elvin[72] found a rough relationship between GNP per capita and current expenditures on education. Similarily, in an earlier investigation, Edding[73] noted that outlays per capita for education were in approximately the same order as national income per capita.

These conflicting results may be explained in a variety of ways. Myers and Harbison suggest that the lack of correlation they found was possibly due to gaps in the data (which were particularly numerous in this area) and to the unreliability of much of the reported information. It should also be noted that the data used by Myers and Harbison covered only public expenditures. Differences between nations in the degree to which education is financed from private sources could have affected their results.

In addition, there are a number of more general reasons why one should not expect a close correspondence between educational expenditures and GNP per capita. Wide differences between nations in the efficiency with which resources devoted to education are employed can easily occur; and, since there are no satisfactory measures of efficiency, such differences are difficult to recognize and balance. Climate, geographical features, the type and abundance of natural resources in various countries may profoundly influence the proportion of national income that must (or should) be expended upon education. In the past, social pressures and different social philosophies have impelled some nations to spend more on education than they might otherwise have done and perhaps more than was actually required.

These considerations imply that such inter-country comparisons should not be wholly relied upon by any one nation in determining what it should spend upon education. If such comparisons are made, they are more likely to be a "political" maneuver to justify a given course of action and obtain popular approval than a sound economic procedure. Each nation must consider its individual circumstances when charting its course.

A more logical method of developing an educational program than the simple use of inter-country comparisons is to employ manpower planning techniques. Some of these techniques will be discussed shortly, when it will be shown that inter-country comparisons may have a part to play in these more comprehensive planning methods, rather than as "islands" separate from the "mainland".

Inter-industry and Inter-firm Correlations

Inter-industry and inter-firm correlations also have been employed to determine the significance of education for economic development. The measures used have included: the percentage of employees at the technical, supervisory, or managerial levels with higher education; the percentage of employees engaged in research; and ratios of scientists and engineers to technicians and other supporting personnel. Such comparisons have been made on cross-sectional bases with individual countries, over time, and between countries.[75]

As with the international comparisons already discussed, there are many complicating factors which make it extremely difficult to draw general conclusions from comparisons of industries. For example, those industries which stress high educational levels among their employees may also possess above-average market power, so that any higher profitability they may have reflects the latter influence as much if not more than the educational differences.[76] John Jewkes, writing with regard to the quantity of resources (human and physical) which should be devoted to research and development has this to say:

> Now different industries vary greatly in almost every imaginable sense: in capital investment per head; in the raw materials consumed per unit of output; in the types of labour employed; in the methods of financing new expansion; in the extent to which they buy finished or semi-finished parts from other industries; and so on. Nobody doubts that these variations represent the proper responses of different industries to the different circumstances which face them. Why, then, should it be assumed that it is a golden rule, an inflexible uniformity, that, in proportion to size, every industry should spend the same proportion on research and development or devote the same proportion of its labour force to these ends?[77]

There may, however, be a stronger case for inter-firm comparisons within industries. For one thing, products and processes will be more similar to one another. Examination of the more advanced firms may be useful in obtaining some idea of the needs for educated people in the future, even if no definite measure of the contribution different types and levels of educated people make to firms is possible. In other words, such comparisons may have merit in the context of broader manpower development plans. This latter subject will be discussed in the next section.

Manpower Forecasting

Rather than attempting to estimate the precise contribution that education makes to economic growth, manpower forecasting has proceeded on the simple but far-reaching assumption that economic growth cannot take place without a stock of trained and skilled people. In under-developed countries, the emphasis has been on providing a domestic labour force which can successfully utilize the physical and monetary capital provided through foreign aid and domestic saving so as to promote development. In better developed economies, the stress has been on continuing and accelerating past levels of growth through the expansion and better utilization of existing human resources.

Most nations today are involved in manpower forecasting to a greater or lesser degree. The Organization for Economic Co-operation and Development has been of prime importance in this field, having initiated both the Mediterranean Regional Project (MRP) and the Educational Investment and Planning Programme (EIP). The former involved agreements with the governments of Greece, Italy, Portugal, Spain, Turkey and Yugoslavia and represented:

> ...an attempt by research teams in those countries, with financial support from the OECD, to assess educational needs in the light of long-term targets for economic and social development, and to make concrete recommendations as to their respective governments for investment in education.[78]

The EIP Programme was instigated for the development and improvement of educational planning in the countries of northern Europe through international consultation and exchange of experiences. Canada and United States also have been observers at the periodic meetings. Therefore, with the exception of Luxembourg, the participation of OECD countries in educational planning programmes is complete.

The degree of sophistication in the studies of the individual countries has largely been a function of the time in which results were wanted, the quantity of resources available, and the quality of statistics. The desired goals probably also exerted a wide influence on the approach employed, although these, too, might be a function of the other factors mentioned. A historical review of the methods developed in individual countries and their varying

degrees of success would be a tedious process and outside the scope of this discussion. Instead, it shall be confined to considering the general methods employed.

Two main approaches have been employed in forecasting educational needs. The first, which will be called the "inflow approach" is oriented towards providing schools and instructors to meet the growing demands for education by the populace. The second is oriented towards meeting the needs of the economy for trained workers.

Projecting Student Inflows

The inflow approach to forecasting is based on the "traditional" view of education as a right of the individual in a democratic society, regardless of his income or class. It stresses the need of the individual for education to develop his human potentialities. Its aim is therefore to provide school facilities according to peoples' desires. To date, this has been the only approach to educational planning emphasized in Canada.[79]

The methodology usually involves examination of the existing age-sex structure, demographic trends (marriages, births, mortality, rural-urban migration, and other population shifts), enrollment-ratios at each level and type of education, legal factors such as age limits for compulsory education, and structural considerations such as teacher-pupil ratios. Extrapolations from these are then made to arrive at estimates of the educational facilities and expenditures required in future years.

There is, however, a dangerous circularity here. The purpose of the forecasts is to guide government policy regarding provision of schools and fellowships, setting of minimum school-leaving age, and establishing pupil-teacher ratios. However, once these policies are in existence, they in turn will alter society's demand for education. The more accessible schools and fellowships become to people in all areas of the country, the more people are likely to demand additional education. It is beyond the scope of this paper to analyze this problem fully, but it is important to recognize the conceptual vagueness of the goal of educating to satisfy cultural requirements. Some studies have been conducted to determine the effects of such influences as accessibility of facilities, family income, and parents' education, but as yet no conclusive results have been obtained.[80]

Another difficulty is that, even if the projections are roughly correct insofar as the desires of students or of parents for

their children are concerned, there is still no assurance that the type of students trained will be what the economy actually requires for production purposes. Considerable misdirection of effort, not to mention thwarted aspirations, may arise. In backward economies, as Van Den Haag and others have pointed out, a pool of unemployed intellectuals may provide the spark for revolution.[81] Clearly, it is not sufficient to look only at satisfying students' demand for classroom space and instructors. The needs of the economy for trained and educated people must be considered as well.

Forecasting Production Needs

In this second approach to educational planning, "...the educational system comes to be viewed as a 'brainpower industry' whose social function is to develop human beings as instruments for building national economic and military strength".[82] The focus is on determining the investment in education necessary for achieving some postulated rate of economic growth.

The determination of future labour requirements generally proceeds along lines similar to those sometimes used in projecting the needs for other factors of production. Demands for factors depend upon both the production functions involved and prices of the factors. However, where fixed coefficients of production are a reality (or at least where the possible substitution between factors is small) production considerations may dwarf those of price. Then, useful approximations of future demands may be obtained by considering only the production side and ignoring price changes. Manpower planning is based upon the assumption, either implicit or explicit, that production considerations are of first importance, that is, that there are fixed (or close to being fixed) labour-output coefficients for the different types of labour, and that these coefficients are determinable. The prices of labour of varying types and qualities in relation to each other and to capital are given only secondary attention.

The end goals of a manpower forecast are estimates of the numbers of people required at the forecast date in each economic activity and occupation and estimates of the numbers of people who must be trained to meet these requirements. Initially, it must be implicitly or explicitly assumed that there will be no major disasters or political upheavals; that the armed forces will be of a certain size; that international trade will continue; that industrial development plans, if any, will have a certain degree of success and so on. The individual steps may vary somewhat from country to country, and within any one country at different points in time, but they will be essentially along the following lines.[83]

The starting point is an analysis of the current structure of employment by economic activity (sectors and industries), and by occupational groups, further subdivided by educational and training attainments, age and sex. Then the civilian labour force must be estimated for the forecast year, and perhaps for one or two intermediate dates, depending upon the length of the total forecast period. These estimates will entail a population forecast adjusted for labour force participation and unemployment rates of men and women by age groups.

Labour force requirements of individual sectors and important industries must then be projected. Guides utilized include past industry - employment trends, existing employment structure, surveys of employers, experience of other countries and most important, projections of industrial output taken from development plans or input-output analyses. However, no one of these guides should be used alone. For example, reliance on past trends or existing employment structure is risky, especially for a developed economy in an era of progress more rapid than ever experienced before. Under such circumstances, past data soon become obsolete. Surveys of employers' requirements are also subject to wide margins of error. Most employers as yet do not make long-range manpower projections and consequently have no concrete idea of their future needs.[84] Also, there is a major problem of preparing questionnaires which avoid possible misinterpretation by respondents.[85] Comparisons with the requirements of more developed countries as a guide to the future are also hazardous. One problem is that of obtaining comparable statistics. Another is that factor proportions will vary among countries. Therefore, even if production functions were identical (which is unlikely) relative factor prices will vary among nations. Consequently different proportions of labour and physical capital will be employed in different countries even at similar stages in their development. Each of these methods, then, should only be used to supplement labour-requirement forecasts based on industrial projections. (If industrial forecasts do not already exist, such projections would have to be made before proceeding further.) Moreover, anticipated improvement in labour productivity, changes in hours of work, and the extent of future research and development must also be considered when making these projections.

Expected labour force requirements in the individual industries or sectors must be summed and the total compared to the total anticipated labour force. When necessary, adjustments and revisions should be made to eliminate inconsistencies between the two aggregates.

Forecast employment in each industry must next be allocated to occupational categories. Guides used may include past employment trends, existing occupational structure, particularly of the more technologically advanced firms, forecasts of technological changes, and comparisons with countries which have already experienced the approximate level of development anticipated for the forecasting country. Anticipated future levels of domestic income may be especially useful in projecting the level of demand for some services and hence some occupations such as those of a medical or recreational nature. Here again, however, no one guide should be relied upon exclusively. Comparisons on an inter-industry, inter-country, or inter-temporal basis are, for reasons mentioned earlier, particularly subject to error. At best such comparisons can only be employed to supplement other information.

Once occupational needs are determined for each industry, aggregation of these demands across industries provides an estimate of the numbers required in each occupational group at the forecast year. These needs can then be translated into educational requirements of both a general and specific nature. Interviews with employers may be undertaken at this point to arrive at levels and types of education required and anticipated for particular occupations. Estimates of educational requirements for jobs as prepared by national employment officers also constitute an important method of arriving at answers to the questions of how much and what kind of education should be provided.[86]

From the above estimates of educational requirements, the required inflow to the labour force of trained personnel can be derived. This involves subtracting anticipated retirements, deaths, withdrawals (such as young women commencing families) and those emigrating during the forecast period from the current stock of workers. A comparison of the expected remaining stock of workers with anticipated total needs indicates the inflow of workers of each type that will be needed over the planning period. The resulting figures can then be matched with the anticipated supply of people in each occupation who will be entering the labour force over the time-horizon of the plan. These entrants may be graduates from educational institutions and apprenticeship programs, scholars who have completed their training abroad, new participants without formal training, transfers from other occupations, and immigrants. (It will be evident that proper manpower planning entails both forecasts of production needs and projections of the numbers of students entering the education system.)

The comparisons of production requirements with the anticipated supplies of labour-force entrants will indicate whether

existing educational facilities are sufficient and of the right type to provide the training required by the labour force of the future, or whether, if current enrollment trends continue, surpluses or shortages of skilled people may arise. Appropriate policy decisions might then be taken to ensure the desired occupational mix.

The empirical difficulties of this approach are immense. Fluctuations in business activity will affect demands for various types of skills; shortages and surpluses of trained manpower are bound to arise.[87] Peoples' incomes will be influenced by business fluctuations and occupational trends. Consequently, the incentives offered to young persons to take up different occupations will be altered. Fellowships, tax-rebates, or similar measures may be required to offset the effects of factor-price changes on incentives. Also, as prices of different types of labour change, there may be changes in labour-output coefficients and therefore in the quantities of each type of labour required in the production process; that is, price elasticities of demand for factors may not be zero or near-zero, as the manpower approach hypothesizes. However, this difficulty may be overcome in part by training men to be flexible among jobs either by teaching them a diversity of skills or giving them sufficient general education to enable them to learn new skills quickly.

There is also the long-run problem of technological change which alters the need for various types of trained people. As seen in this past decade, the need for entire occupations has been eliminated (e.g., railway firemen). To some extent, the more technically progressive firms and industries may be used in guiding future projections, although even these will not provide a complete picture. Here again if men are trained to be flexible among jobs, the seriousness of technological change may be lessened in part. Men will be able to alter their occupations with a minimum of retraining. However, the whole area of job substitutability is one which requires much investigation.

Another difficulty is that preparation for various jobs can be obtained by several routes - apprenticeship, on-the-job training, and formal schooling. A whole range of problems arises regarding which type of facilities should be provided, which is the most efficient approach, and what quality of worker is required. Associated problems include what pupil-teacher ratios should be assumed, and what type and length of training teachers themselves should have.

This enumeration of the difficulties that may arise in devising a workable manpower plan could be greatly expanded.

However, those already listed are sufficient to indicate that manpower planning is not an exact science. At best it is an art, still in its infancy. Many assumptions and informed judgments are necessary to compensate for gaps in data. But if planning of any sort were delayed until our data were complete and a fool-proof methodology was developed, no forecasts of educational needs would ever be made. The enormous outlays on education today and in the future demand that we at least make an attempt to determine how we can best allocate these expenditures to meet our needs efficiently. As additional data become available and greater experience is gained in the techniques of manpower planning many of the difficulties presently facing us will be overcome. Manpower forecasting, although far from an ideal approach to rational development of our educational resources at least provides a framework for analysis and a guide to the gathering of additional required data that no other currently-known method offers.[88] We can therefore expect that manpower forecasting in one of its forms will constitute a permanent part of the development program of most nations. As a conclusion to our discussion of manpower forecasting and educational planning we shall briefly review one rigorous planning approach which has received considerable attention in recent years - the use of econometric models.

Correa-Tinbergen-Bos Models

The basic econometric model of education is of an input-output type. However, instead of fixed capital-coefficients relating the growth path of national product to the stock of required physical capital and investment flows, labour-output coefficients are employed to specify the requirements of educated workers for the continued growth of national product at some designated rate. The system, consisting of linear difference equations, is briefly as follows:

(1) $N_t^2 = \nu^2 V_t$

(2) $N_t^2 = (1-\lambda^2)N_{t-1}^2 + m_t^2$

(3) $m_t^2 = n_{t-1}^2 - n_t^3$

(4) $m_t^3 = n_{t-1}^3$

(5) $N_t^3 = (1-\lambda^3)N_{t-1}^3 + m_t^3$

(6) $N_t^3 = \nu^3 V_t + \pi^2 n_t^2 + \pi^3 n_t^3$

where

t = the time period = 6 years

V = volume of production of the country

N^2 = the stock of labour force participants with a secondary education

N^3 = the labour force members with higher or third-level education

m^2 = those who joined the N^2 labour force within the past six years

m^3 = those who joined the N^3 labour force within the past six years

n^2 = the students in secondary education

n^3 = students in higher education

ν^2 = the proportion which the labour force with secondary education must be of the volume of national output

ν^3 = the proportion which the labour force with higher education must be of the volume of national output

λ^2 = the proportion of those in the labour force with secondary education at one unit of time who drop out due to death or retirement by the next time unit

λ^3 = the proportion of those in the labour force with third level education who drop out due to death or retirement by the next time unit

π^2 = the teacher-student ratio for those with higher education employed instructing students at the secondary level

π^3 = the teacher-student ratio for those with higher education employed instructing students at the higher education level

Primary education is assumed not to be a bottle-neck and is disregarded.

Tinbergen has refined this basic model to allow for the stock of necessary labour force participants with secondary education depending not only on the level of production but also on per capita income; for the disaggregation of production and thus of manpower requirements into two sectors; for the wastage of educational efforts arising due to not all students graduating, or - if they do graduate from secondary schools - not continuing with higher education or entering the labour force; for the elimination of surpluses of manpower with given educational attainment; and for accelerating the growth of the economy with or without foreign assistance.

The model is admittedly a crude beginning and as such leaves many necessary elaborations and generalizations unconsidered. The authors are well aware of this as indicated by the following quotation:

> The structure of the model may be refined in an almost endless number of ways: by introducing more types of production and more kinds of education. Numerous factors influencing both the demand for and the supply of trained labour may be introduced explicitly. The authors hope that this article will stimulate some of these kinds of generalization.[90]

The basic weakness of the model stems from its being nothing more than an adaptation of the popular two-sector physical-capital models involving a fixed capital-output ratio, allowance for depreciation, and real capital from one sector being used to produce the output in the second sector. (The above system of equations can in fact be interpreted as a standard capital model in which secondary and higher education are two types of capital, the allowances for mortality and retirement are depreciation, and the output of the one sector (higher education) is employed to produce national output as well as machines (men) for both sectors. If one thinks in terms of education being investment in human capital, the analogy is complete.)[91]

Probably the most serious problem centres on the depreciation to be allowed. With physical capital it is common to assume "ratio-active" depreciation (i.e., depreciation at a fixed rate proportional to the capital stock). However, such an assumption is quite unsatisfactory for human capital:

> ...neither the retirement nor death of human beings can be taken to be even approximately

> independent of age...if the stock has been built up by training numbers of people in the immediate past, the forces of death and retirement will be relatively low, whereas if the same stock were built up over a longer period with a higher average age, these forces will be relatively high. This means that, in discussing alternative time paths of adjustment, it will be right to assume a rather low ratio of depreciation for a quicker adjustment to a high requirement than for a slower adjustment to the same requirement.[92]

Furthermore, humans learn from experience, but machines do not. Rentals on older machines tend to be uniformly below that on new machines, but older (and more experienced) men with given amounts of education generally earn larger amounts than young men. In a model of the type discussed here, such influences would have to be allowed for through an appreciation factor or changing labour-output ratios as the ages of workers alter.

For practical planning purposes, more than two sectors must be used if meaningful results are to be obtained. Not only do the ratios of manpower of various levels of skill and education to output vary considerably among sectors, but changes in the relative importance of different sectors, even though there is no alteration in the productivity in individual ones, will result in shifts in the aggregate labour-output ratios. Also, not only must different levels of education be considered, but different types of education at the same level must be provided for in planning.

In view of these complexities, it is not surprising that attempts to employ this model in the Mediterranean countries of Greece, Spain and Turkey have met with something less than unqualified success. To illustrate, when the model was applied to Greece it became apparent that there was a considerable disparity between it and the ability of Greece to satisfy it. For the period after t 1 (i.e., after 1967) the number of students required in secondary education exceeded the expected population in the relevant age group![93] Refinements in the basic model will obviously be necessary before meaningful results are obtained.

Sen[94] suggests that perhaps the place of this approach is in finding the minimum requirements rather than the optimum education needs and that these would be of real value to the underdeveloped countries. That is, the model would be used to specify minimum education necessary, given the maximum amount of substitutability among men of different training and between men

and machines. However, this possibility is not borne out by the Greek experience just mentioned. There, the model seemed to specify something like maximum requirements rather than minimum ones. Furthermore, even in defining minimum requirements, production functions would have to be determined so that the degree of substitutability could also be defined. Thus, determining minimum requirements would be no easier than determining optimum ones. As yet, however, both goals appear to be some distance in the future.

In summary, then, this model faces all the difficulties which the more conventional type of manpower forecasting faces, such as lack of adequate data, insufficient information about elasticity of substitution among men of different educational levels and between men and machines, and inability to foresee the nature and direction of technological change. But, in addition, it suffers from being essentially a physical-capital model interpreted as a human-capital model in which the problems of changing coefficients, depreciation, and disaggregation of sectors are much more awkward when one attempts to make practical use of it. Its value as yet is more as a theoretical concept which points up a number of the key relationships and problems in manpower planning. It demonstrates that it is insufficient to look only at manpower needs at the target date. One must also consider the paths by which the economic and educational systems move towards the target, or else transition disequilibrium may occur. And, as Bombach[95] has pointed out, even if balanced growth is not realized (as the solution of the model implies), it remains a useful long-run concept just as equilibrium age-distribution models are useful in population study even though the equilibrium structure is never attained. For practical purposes, however, reliance must, for now, be placed upon less rigorous but more workable methods. But continued work on the refinements of the Tinbergen model will undoubtedly yield future rewards.

Conclusions

A number of different approaches to the relationships between education and economic growth have been discussed. We have observed that opinions differ greatly regarding the best avenue of research to pursue. Certain conclusions were reached, however, and these are now summarized:

1. The concept of human capital is useful for certain purposes such as measuring the total productive capability of countries in terms easily related to physical capital, reconciling the constancy of the relative share of labour in national output even though the rates of increase in physical capital and labour force adherents have differed, and estimating the capital value of immigration and emigration.

2. The calculation of social returns to expenditure on education is fraught with complications. Rates-of-return computations are not a satisfactory way of determining either the proportion of a nation's resources that should be devoted to education or the types of education and training that should be most encouraged. Further research along these lines appears to be of doubtful value.

3. The computation of private rates-of-return may be useful both for guiding people in their choice of occupations and for guiding governments in providing incentives to people so as to achieve the occupational mix the economy requires.

4. Research involving determination of the many different factors which contribute to economic growth (of which education is one) holds some promise for the future. This seems to be the best known available method, as yet, for analyzing the sources of economic growth.

5. International, inter-temporal, and inter-industry comparisons of GNP and educational levels or educational expenditures by themselves provide insufficient information for any country wishing to develop an educational program. Such comparisons are more appropriately considered as techniques useful in supplementing more comprehensive manpower planning methods.

6. Manpower programming provides a valuable framework for determining educational requirements for economic development. Although the data need to be improved and the methods of planning refined, this appears to be an obvious focal point for future economic work in the field of education.

Footnotes

[1]The above categorization of approaches to the economics of education was suggested by W.G. Bowen's paper "Assessing the Economic Contribution of Education: Appraisal of Alternative Approaches," in Economic Aspects of Higher Education (Paris: OECD, 1964). See also his recent publication Economic Aspects of Education: Three Essays, Research Report No. 104. Princeton: Industrial Relations Section, Department of Economics, Princeton University, 1964. Other general discussions of the economics of education are to be found in John Vaizey, The Economics of Education (London: Faber and Faber, 1962); and T.W. Schultz, The Economic Value of Education (New York: Columbia University Press, 1963).

[2]"Education and Economic Growth," Economics of Higher Education, ed. Selma J. Mushkin (Washington: Government Printing Office, 1962), pp. 104 and 108.

[3]It can be argued that business "investments" also contain a consumption component. The mahogany panelling or thick carpeting in the executive's office or the beautified exteriors and grounds of office buildings and plants may be offered as evidence of the existence of consumption elements. However, the size of the consumption component in most physical capital installations is small relative to the total investment involved. Consequently, separating consumption from investment is not generally a problem worthy of concern. Moreover, businessmen would not be profit maximizers if they permitted the consumption component of their investments to assume significant proportions.

[4]E.g., see Ingvar Svennilson, Friedrich Edding, and Lionel Elvin, Targets for Education in Europe in 1970, Policy Conference on Economic Growth and Investment in Education, Washington, 1961 II (Paris: OECD, 1962), pp. 22-25.

[5]E. Renshaw, "Estimating the Returns to Education," Review of Economics and Statistics, 42 (August, 1960), pp. 321, has suggested that the educational process may also yield negative satisfaction due to students being forced to learn material they are not interested in and which will be of little future value to them.

[6]Economics of Higher Education, p. 107. See also Michael Kaser, "Needs and Resources for Social Investment," International Social Science Journal, 12 (No. 3, 1960), pp. 413-415.

[7]W.G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches," p. 17.

[8]H.E. Brazer, City Expenditures in the United States (New York: NBER, 1959). T.W. Schultz, "Capital Formation by Education," Journal of Political Economy, 68 (December, 1960), pp. 577-579. See also computations by: Z. Hirsch, Analysis of the Rising Costs of Public Education, Congressional Joint Economic Committee, 86th Congress, 1st. Session (Washington: Government Printing Office, 1959); and S. Fabricant, The Trend of Government Activity in the United States Since 1900 (New York: National Bureau of Economic Research, 1952).

[9]As is done in Chapter 2 of this paper.

[10]Mary Jean Bowman distinguishes between the stock of human capital and the flow of inputs into productive processes which are the result of educational expenditures on humans. She conceives the possibility of measuring the "rental-value" of these educational inputs (or "Eds" as she calls them) and the extent of their contribution to economic growth without the need of estimating the stock of human capital at any given time. In this way she avoids the problem of determining the portions of educational outlays which are consumption and investment. Her schema will be valuable for the particular purposes she has in mind. But it does not resolve the consumption-investment problem when an estimate of the stock of human capital is required. See "Schultz, Denison, and the Contribution of 'Eds' to National Income Growth," Journal of Political Economy, 72 (October, 1964), pp. 450-464.

[11]John Vaizey, The Economics of Education, pp. 51-52. See also S. Strumilin, "The Economics of Education in the U.S.S.R., "International Social Science Journal, 14 (1962), p. 641.

[12]For an excellent discussion of the weaknesses in the argument of those opposing the use of the foregone-earnings concept see Mary Jean Bowman, "The Costing of Human Resource Development," International Economic Association, Conference on the Economics of Education, August 29-September 7, 1963, pp. 4-9.

[13]T.W. Schultz, The Economic Value of Education (New York: Columbia University Press, 1963), pp. 28-32.

[14]The Economics of Education, p. 132. Also, Vaizey is prepared to accept estimates of the value of time saved by people using Britain's London-Birmingham superhighway as a dollar benefit from its construction (pp. 47-48). There is little difference in principle between this and treating as a cost of schooling the dollar value of the time involved in obtaining that schooling.

[15]For example, T.W. Schultz, Journal of Political Economy, 68; and Rudolf Blitz, "The Nation's Educational Outlay," Economics of Higher Education (Washington: Government Printing Office, 1962), pp. 147-169. For a discussion of the case for excluding adjustment for unemployment, see Mary Jean Bowman, "The Costing of Human Resource Development," p. 7.

[16]Blitz, p.155 takes this view, as does Fritz Machlup in The Production and Distribution of Knowledge in the United States (Princeton, New Jersey: Princeton University Press, 1962) p. 95.

[17]R.S. Eckaus, The Economics of Higher Education, p. 114.

[18]The Production and Distribution of Knowledge..., p. 94.

[19]The Economics of Higher Education, p. 114.

[20]"The Nation's Intellectual Investment," Bulletin of the Oxford University Institute of Statistics, 18 (August, 1956), p. 285.

[21]The Economic Value of Education, p. 26.

[22]An exception is Machlup, pp. 52-56.

[23]For a different method of arriving at the same conclusion see Mary Jean Bowman, "Professor Machlup on Knowledge and Reform," School Review, (Summer, 1963), pp. 238-239.

[24]Journal of Political Economy, 68, pp. 571-583. He in turn relied on work by Robert Rude, "Assets of Private Nonprofit Institutions in the United States, 1890-1948," (NBER, 1954) (Unpublished).

[25]The Costs of Education (London: George Allen and Unwin, 1958).

[26]"The Nation's Educational Outlay," Economics of Higher Education, Table 1.

[27]Production and Distribution..., p. 99.

[28]See Universities-National Bureau Committee for Economic Research, Public Finances: Needs, Sources, and Utilization (New York: NBER, 1961), esp. pp. 453-460.

[29]Harold F. Clark and Hugh E. Sobkov erroneously included such costs in How Much Can the People of the United States Afford to Spend on Education? (New York: Teachers College: Columbia University, undated, about 1958); they estimated such costs at 40 per cent of the total costs of education in 1956-1957. J.R. Walsh, "Capital Concept Applied to Man," Quarterly Journal of Economics, 49 (February, 1935), pp. 255-285, also made the error of including such expenditures.

[30]See "Education and Economic Growth," in Social Forces Influencing American Education ed. N.B. Henry (Chicago: University of Chicago Press, 1961), p. 59.

[31]Ibid. See also The Economic Value of Education.

[32]"The Political Economy of Opulence," Canadian Journal of Economics and Political Science, 26 (November, 1960), p. 563. The article is reprinted in The Canadian Quandry (Toronto: McGraw Hill, 1963), pp. 236-252. See also Robert M. Solow, "A Skeptical Note on the Constancy of Relative Shares," American Economic Review, 48 (September, 1958), pp. 618-631.

[33]"The Valuation of Human Capital," Journal of Political Economy, 69 (October, 1961), pp. 425-436.

[34]Review of Economics and Statistics, 42 (August, 1960), pp. 322-323.

[35]"Investment in Human Capital," Journal of Political Economy, 70 (Supplement: October, 1962), pp. 9-49; also Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education (New York: National Bureau of Economic Research, 1964), espec. Part I.

[36]Cf. Eckaus, "Investment in Human Capital: A Comment," Journal of Political Economy, 71, (October, 1963), pp. 501-504.

[37]"On-the-Job Training: Costs, Returns, and Some Implications," Journal of Political Economy, 70 (Supplement: October, 1962), pp. 50-79.

[38]Ibid., p. 59.

[39]In a perfect market, these two methods of estimation would of course give the same results. The cost approach is used only as a good approximation to the more economically correct discounted value approach.

[40]Journal of Political Economy, 69 (October, 1961), pp. 425-436.

[41]Quarterly Journal of Economics, 49 (February, 1935), pp. 255-285.

[42]Milton Friedman and Simon Kuznets, Income from Independent Professional Practice (New York: NBER, 1945).

[43]H.S. Houthakker, "Education and Income," Review of Economics and Statistics, 41 (February, 1959), pp. 24-28.

[44]Human Capital..., Part II, espec. Chapter 4.

[45]These ideas are developed more fully in another paper which is presently being prepared for publication by the author.

[46]Cf. Shane J. Hunt, Income Determinants for College Graduates and the Return to Education Investment (New Haven: Yale University Economic Growth Center, 1964); also Becker, Human Capital....

[47]W. Lee Hansen, "Human Capital Requirements for Educational Expansion: Teacher Shortages and Teacher Supply," Conference on Education and Economic Development (Chicago, April 4-6, 1963), p. 7.

[48]The reader may wonder why we favour use of net returns' calculations as guides to occupational choice and government policies in education or in the labour markets, yet reject them so strongly for resource allocation. The basic reason is that in the first use, it does not matter whether the returns calculated reflect a truly competitive situation or not. They are the returns which exist in the market and the ones at which people look in selecting their occupations. Similarly, governments may alter these net returns by wage policies or fellowships and thereby influence individuals' occupational choices. Once we wish to use returns as guides to resource allocation, however, the presence of monopolistic elements is a severe drawback.

[49]See Burton A. Weisbrod, "Education and Investment in Human Capital," Journal of Political Economy, 70 (Supplement: October, 1962), pp. 106-123.

[50]Cf. T.W. Schultz, The Economic Value of Education, pp. 42-46.

[51]Human Capital...Chapter 5.

[52]Ibid., p. 121.

[53]"Capital Formation: A Theoretical and Empirical Analysis," Review of Economics and Statistics, 64 (May, 1962), pp. 120-121.

[54]Cf. Alice Rivlin, Economics of Higher Education, p. 371; also Machlup, p. 121.

[55]Cf. Mary Jean Bowman, "Social Returns to Education," International Social Science Journal, 14 (1962), pp. 647-659.

[56]See Edward F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us (New York: Committee for Economic Development, 1962), pp. 77-78.

[57]E.g., Jacob Schmookler, "The Changing Efficiency of the American Economy: 1869-1938," The Review of Economics and Statistics, 34 (August, 1952), pp. 214-231; also John W. Kendrick, "Productivity Trends: Capital and Labour," The Review of Economics and Statistics, 37 (August, 1956), pp. 248-257; also Moses Abramovitz, "Resource and Output Trends in the United States since 1870," American Economic Review, Papers and Proceedings, 46 (May, 1956), pp. 5-23; also Robert M. Solow, "Technical Change and the Aggregate Production Function," The Review of Economics and Statistics, 39 (August, 1957), pp. 312-320.

[58]E. Domar has provided a careful analysis of the major variations in "On the Measurement of Technological Change," Economic Journal (December, 1961), pp. 709-729. Also see the recent review article by F.H. Hahn and R.C.O. Matthews, "The Theory of Economic Growth: A Survey," Economic Journal, 74 (December, 1964), pp. 779-902.

[59]The Sources of Economic Growth..., especially Chap. 7.

[60]"Comments on Mr. Edward F. Denison's Paper," The Residual Factor and Economic Growth (Paris: OECD, Study Group in the Economics of Education, 1964), pp. 67-73.

[61]"Comments on Mr. Edward F. Denison's Paper," The Residual Factor and Economics Growth...,pp. 57-66.

[62]"Comments on Mr. Edward F. Denison's Paper," The Residual Factor and Economic Growth...,pp. 74-77.

[63]See M. Abramovitz, "Economic Growth in the United States: A Review Article," American Economic Review (September, 1962), pp. 214-231.

[64]For a more detailed analysis of Denison's technique and its implications, see Mary Jean Bowman, "Schultz, Denison and the Contribution of 'Eds' to National Income Growth," Journal of Political Economy, 72 (October, 1964), pp. 450-464.

[65]The Market for College Graduates (Cambridge: Harvard University Press, 1949), esp. pp. 160-165.

[66]"The Theory of Social Expenditure," Administration, 5 (No. 1), pp. 77-88.

[67]See p. 8.

[68]Charles A. Myers and Frederick Harbison, Education, Manpower, and Economic Growth: Strategies for Human Resource Development (New York: McGraw Hill, 1963).

[69]Ibid., pp. 31-32.

[70]Ingvar Svennilson, Friedrich Edding, and Lionel Elvin, Targets for Education in Europe in 1970, esp. pp. 72 and 85.

[71]Alison Martin and W. Arthur Lewis, "Patterns of Public Revenue and Expenditure," Manchester School of Economics and Social Science, 23 (September, 1956), pp. 203-244.

[72]Targets for Education in Europe in 1970, p. 92.

[73]Friedrich Edding, International Tendenzen in der Entwicklung der Ausgaben fur Schulen und Hochschulen (Kiel, 1958), cited by John Vaisey, The Economics of Education, pp. 55-58.

[74]Cf. Michael Kaser, "Needs and Resources for Social Investment," International Social Science Journal, 12 (No. 3, 1960), pp. 415-419.

[75]See George L. Payne, Britain's Scientific and Technological Manpower (Standford: University Press, 1960); or Nicholas de Witt, Education and Professional Employment in the U.S.S.R. (Washington: NSF, 1961).

[76]Bowen, Economic Aspects of Education..., p. 9.

[77]"How Much Science," Economic Journal, 70 (March, 1960), p. 10.

[78]Alexander King, in the Foreword to Forecasting Educational Needs for Economic and Social Development by Herbert S. Parnes (Paris: OECD, 1962), p. 3.

[79]An exception to this statement is the work by the Economics and Research Branch of the Department of Labour, Ottawa. See particularly Long Range Manpower Forecasting (1963), and their Professional Manpower Studies Nos. 5, 8, and 13 entitled Employment Outlook for Professional Personnel in Scientific and Technical Fields: 1958-1960, 1960-1962, and 1962-1964 respectively.

[80]See Educational Testing Service, Background Factors Relating to College Plans and College Enrollment Among Public High School Students (Princeton, 1957), processed.

[81]Ernest Van Den Haag, Education as an Industry (New York: Kelly, 1956), pp. 127-130; also Bert F. Hoselitz, "Investment in Education and its Political Impact in Developing Countries," prepared for Conference on Education and Political Development, Lake Arrowhead, California, June, 1962. Sponsored by Social Science Research Council, New York. For an opposing view, see Philip J. Foster "The Vocational School Fallacy in Development Planning," Conference on Education and Economic Development, (April 4-6, 1963), esp. pp. 10-12, where he argues that students' aspirations depend more upon what they perceive are their opportunities rather than on the type of education they have received. (However, he does agree that planning for more students without considering what the economy needs is a real waste.) Mary Jean Bowman has suggested that the best way to overcome any surplus of intellectuals is to produce more of them so that as a group they begin to lower their expectations and take on lower-status occupations where their training can still be useful; "Education Shortage and Excess," Canadian Journal of Economics and Political Science, 29 (November, 1963), p. 450. This may work in some countries such as India where those trained in law, for example, might well take teaching posts in the smaller centres, but it would seem more efficient to attempt training people in the first instance for the jobs that are particularly in demand – especially when the total resources to be divided among education and other projects are in limited supply.

[82]Phillip H. Coombs, "Educational Planning in the Light of Economic Requirements," Forecasting Manpower Needs for the Age of Science (Paris: OEEC, 1960), p. 26.

[83]See Herbert S. Parnes, Forecasting Educational Needs for Economic and Social Development (Paris: OECD, 1962); also Employment Forecasting (Paris: OECD, 1962); and Forecasting Manpower Needs in the Age of Science (Paris: OECD, 1960).

[84]See the excellent study by Douglas Hartle, The Employment Forecasting Survey (Toronto: University of Toronto Press, 1962).

[85]David Blank and George Stigler, in The Demand and Supply of Scientific Personnel (New York: NBER, 1957), make a thorough analysis of this approach and point out its weaknesses.

[86]In Chapter 3 this possibility is discussed in greater detail.

[87]The question of what is a "shortage" or "surplus" is one to which considerable attention has been devoted. For an account and assessment of the major views that have been expressed, the reader is referred to Alice Rivlin, Economics of Higher Education, pp. 375-378; also M.J. Bowman, "Educational Shortage and Excess," Canadian Journal of Economics and Political Science, 29 (November, 1963), pp. 446-461.

[88]For an opposing view see C. Arnold Anderson and Mary Jean Bowman, Educational Planning, pp. 19-31.

[89]The first such model was by H. Correa in The Economics of Human Resources (Netherlands Economic Institute, 1962), Chap. 14. Another presentation, a slight simplification of the Correa model, is to be found in H. Correa and J. Tinbergen, "Quantitative Adaptation of Education to Accelerated Growth," Kyklos, 15 (December, 1962), pp. 776-786. Elaboration of this is to be found in J. Tinbergen and H.C. Bos, "A Planning Model for the Educational Requirements of Economic Development," The Residual Factor and Economic Growth, pp. 147-169.

[90]Correa and Tinbergen, Kyklos, 15, p. 786.

[91]Cf. Amartya K. Sen, "Comments on the Paper by Messrs. Tinbergen and Bos," The Residual Factor and Economic Growth, pp. 188-197.

[92]Ibid., p. 189-190.

[93]James Blum et. al., "Applications of the Correa-Tinbergen-Bos Model to Greece, Spain, and Turkey," OECD, DAS/PD/63.40, Meeting on the Residual Factor and Economic Growth, May 20-22, 1963 (mimeographed). Also see Econometric Models of Education: Some Applications, (Paris: OECD, 1965).

[94]"Comments on the Paper by Messrs. Tinbergen and Bos," The Residual Factor and Economic Growth.

[95]See The Residual Factor and Economic Growth.

⋆ 2 ⋆

Human Capital Values of Canadian Immigration and Emigration

Introduction

In few countries have immigration and emigration played such significant roles as in Canada. In this chapter these movements are examined over the decade 1951-1961 in terms of the human capital costs involved.

The discussion begins with a brief historical outline of Canadian immigration and emigration. Subsequently, immigration and emigration for the 1951-1961 decade are quantified in terms of the total years of education and estimated educational costs involved. The educational costs are then related to total domestic educational expenditures and gross national product. Settlers' effects, migrants' funds and costs of raising children (other than educational outlays) are also introduced. Finally, several concluding observations are drawn.

Past Trends in Canadian Immigration and Emigration

Researchers studying migration to and from Canada are continually confronted by the absence of detailed and reliable data on this important aspect of Canadian development. At least three estimates of immigration and emigration are available for the period since 1851.[1] In their examination of the years preceding the mid-nineteenth century, few writers have had the temerity to make detailed estimates.

In spite of the lack of agreement on the actual numbers of persons involved, there is some accord on the general trends that have occurred. In broad terms, Canada has experienced a variable influx of new families from Europe and the British Isles. At the same time, there has been considerable migration back and forth over what is now the Canadian-American border.[2]

The earliest settlers in what is now Canada were the French who had arrived at intervals over the 150 years prior to British ascent to power in the mid-eighteenth century. In 1755, came the forced deportation of many French Acadians to colonies stretching from Massachusetts to Georgia. Subsequently, offers of new land on the Bay of Fundy coastline and the economic pressures of overcrowding in the New England colonies brought many New Englanders to Canada. After 1775 the Loyalist movement swelled the tide of migration from United States to British territories. Some "late loyalists" and American farmers in search of better lands continued entering the country until the war of 1812.

In the early years of the 19th century some Scottish Highlanders settled in Cape Breton Island and Prince Edward Island; otherwise, however, the number of British immigrants to Canada remained small until after the Napoleonic wars.

The real beginning of Canadian migrations to the United States - which were to be a common occurrence in the following 150 years - came in 1837 when many people from Nova Scotia, New Brunswick, and French Canadians from Lower Canada, joined in the movement to the prospering mill towns of New England.

Table 2 presents estimates made by the Dominion Bureau of Statistics for the period after 1850 of Canada's population growth and its components. Prior to the turn of the century, the peak migrant flows apparently occurred during the decade 1881-1891.[3] Although immigration was high, emigration exceeded it by 200,000. Most of those involved in the exodus were former immigrants to Ontario and Quebec who were now moving to the newly opened-up Prairie States where land grants were more easily obtainable than in Western Canada.

With the revival of world markets for wheat in the 1890's and the concomitant opening up of the Canadian West, a new surge of migration took place. Immigration for the decade 1901-1911 totalled 1,759,000. People, attracted by offers of cheap land, came from the British Isles, Europe, and also from United States. This influx was halted by the First World War, but in 1920 it started again and persisted throughout most of the ensuing decade.

TABLE 2
CANADIAN POPULATION BALANCE SHEET
1851-1961
(thousands)

Period	Births (1)	Deaths (2)	Immigration (3)	Emigration (Residual) (4)	Population at end of Decade (5)	Natural Increase		Net Immigration		Total Percentage Change (10)
						Number (6)	Per Cent[1] (7)	Number (8)	Per Cent[1] (9)	
1851	-	-	-	-	2,436	-	-	-	-	-
1851-1861	1,281	611	209	85	3,230	670	27.5	+124	+5.0	32.5
1861-1871	1,369	718	187	379	3,689	651	20.2	-192	-5.9	14.3
1871-1881	1,477	754	353	440	4,325	723	19.6	-87	-2.3	17.3
1881-1891	1,538	824	903	1,109	4,833	714	16.5	-206	-4.8	11.7
1891-1901	1,546	828	326	506	5,371	718	14.9	-180	-3.7	11.2
1901-1911	1,931	811	1,759	1,043	7,207	1,120	20.9	+716	+13.3	34.2
1911-1921	2,338	988[2]	1,612	1,381	8,788	1,350	18.7	+231	+3.2	21.9
1921-1931	2,415	1,055	1,203	974	10,377	1,360	15.5	+229	+2.6	18.1
1931-1941	2,294	1,072	150	242	11,507	1,222	11.8	-92	-.9	12.7
1941-1951	3,186	1,214	548	379	13,648[3]	1,972	17.1	+162	+1.5	18.6
1951-1961[4]	4,468	1,320	1,543	462	18,238	3,148	23.1[5]	+1,081	+7.7	30.8
Totals	23,843	10,195	8,793	7,000		13,648		+1,793		

Sources: 1851 to 1951: Canada, Dominion Bureau of Statistics, Canada Year Book: 1957-58 (Ottawa: Queen's Printer, 1958), p. 160.
1961: Canada, Department of Citizenship and Immigration, Economic and Social Research Division, The Basic 1961 Census Data on Immigration and Citizenship (Ottawa: 1963), p. 2.

Notes:
1 Percentage of population at beginning of the period.
2 Excludes extra mortality associated with World War I, estimated at 120,000.
3 Excludes Newfoundland which became a province of Canada in 1949 and had a population of 361,416 in 1951, making the total Canadian Population 14,009,000 which figure is used for 1951-1961.
4 Includes Newfoundland.
5 Percentage based on Canada with Newfoundland, i.e., on 14,009,000.

Emigration, mainly to the United States, was substantial throughout the first three decades of the twentieth century. For example, during the period 1921-1931, Canadians made up nearly a quarter of the total immigrants to America.

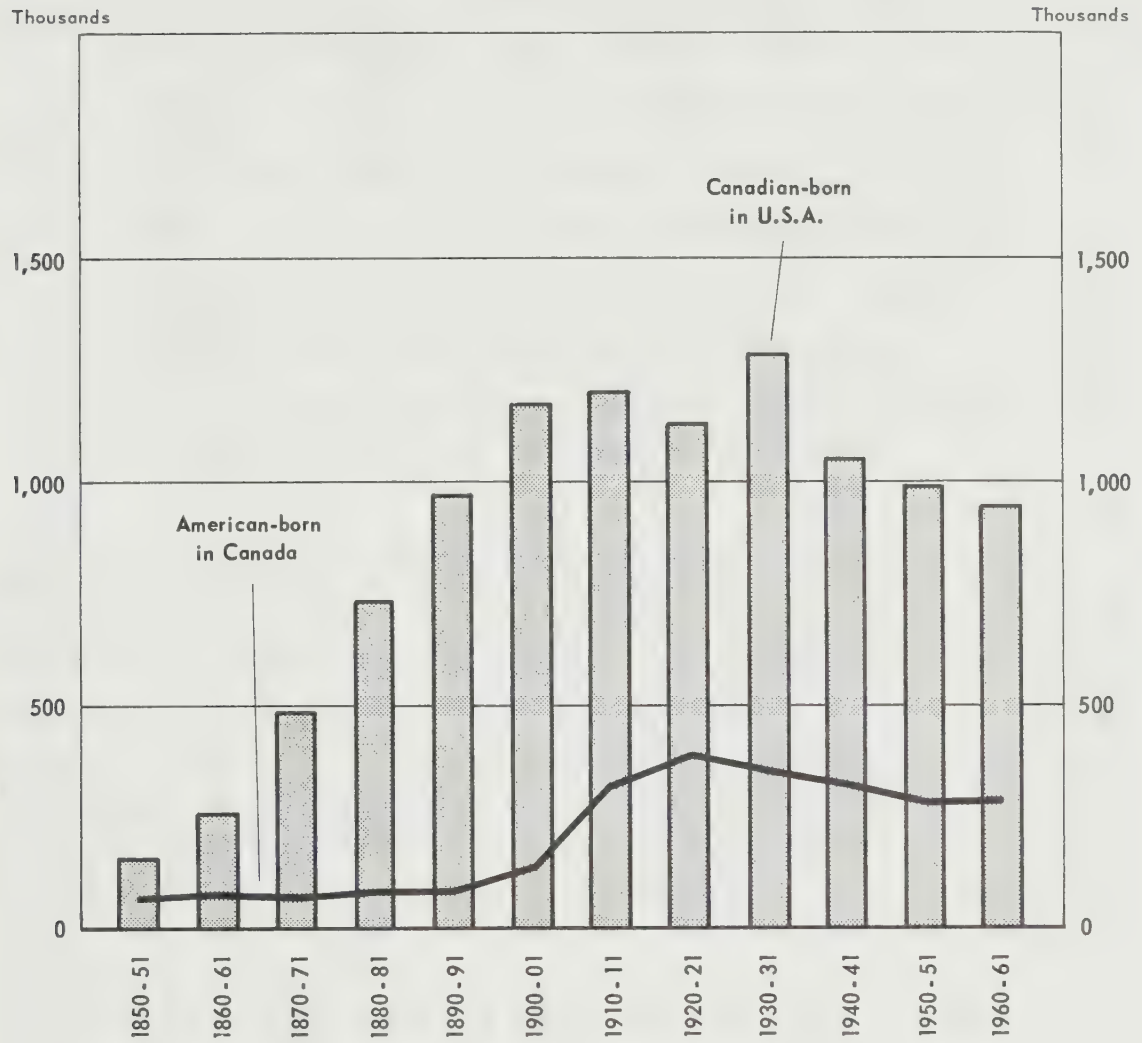
With the coming of the world depression in the 1930's, international movements of people greatly diminished. Immigration was lower than for any other decade since 1850, and was exceeded by emigration. A net outflow continued during World War II, but this trend was reversed in 1946 when the victims of European turmoil began to pour into Canada. The net result for the 1940's was a small margin of immigration over emigration. In the ten years 1951-1961, net immigration (immigration less emigration) of over one million people made a larger absolute contribution to Canada's population growth than in any other decade in the nation's history.

A tabulation of population movements for the entire period 1851-1961 indicates that Canada has lost through emigration 7,000,000 persons, or 80 per cent of the total immigration (8,793,000) for this period. Natural increase has thus had to account for most of the rise in Canadian population.

A large percentage of these population movements across Canada's boundary have been to and from the United States. Consequently, it is worthwhile to examine in closer detail the pattern and nature of these movements. Chart 1 shows the numbers of Canadian-born people in the United States and American-born people in Canada according to the decennial census figures of each country. Up to the turn of the century, there was an increasing number of Canadian-born people in the United States whereas the number of Americans in Canada rose very little. It was in the subsequent twenty years that the bulk of the American influx to Canada occurred. However, this was also an era of much emigration to the United States, as the 1930 United States census figures indicate. The declining numbers of Canadian-born people in the United States since that date are a result of the sharp drop in emigration during the depression years and the Second World War. This decrease in the emigration of Canadian-born people to the United States is apparent from the 1950 age-structure of this group in America. Fifty per cent of the Canadian-born were over 50 years of age, but only 22 per cent of the entire American population were in this class.[4]

There has been much talk both in Canada and in the United States about the loss to Canada of a disproportionate number of professional and skilled personnel. The idea is not a new one.

CHART 1
CANADIAN-BORN POPULATION IN THE UNITED STATES
AND AMERICAN-BORN POPULATION IN CANADA
1850-51 to 1960-61



Sources: 1. 1850-51 to 1930-31: R. M. Coats and M. C. McLean, The American-born in Canada: A Statistical Interpretation (Toronto: The Ryerson Press, 1943), pp. 23, and Leon R. Truesdell, The Canadian-born in the United States: An Analysis of the Statistics of the Canadian Element in the Population of the United States 1850 to 1930 (New Haven: Yale University Press, 1943), pp. 10-13.

2. 1940-41 and 1950-51 for Canadian-born in U.S.A.: U.S. Department of Commerce Bureau of the Census, Statistical Abstract of the United States: 1958 (Washington: U.S. Government Printing Office, 1961) p. 35.

3. 1940-41 and 1950-51 for American-born in Canada: Canada, Dominion Bureau of Statistics, Canada Year Book: 1957-58 (Ottawa: Queen's Printer), p. 138.

4. 1960 Canadian-born in U.S.A., U.S. Department of Commerce, Bureau of Census, 1960 Census: Vol. I-D. Detailed Characteristics of the Population. (PC(1)-1D) (Washington: U.S. Government Printing Office).

5. American-born in Canada: Canada, Dominion Bureau of Statistics, 1961 Census of Canada, Vol. I, Part 3 Population: Birthplace and Citizenship by Age Groups (Ottawa: Queen's Printer) Table 89.

Note: Statistics up to and including 1930-31 include non-white population. Thereafter, only white population is shown. The numbers of non-whites involved are relatively small (8,000 out of 1,286,000 in 1930-31) so the change does not greatly affect the presentation.

Truesdell,[5] using unpublished data from the 1910 United States Census, demonstrated that this situation prevailed even then. Hansen and Brebner write of it as well:

> For many years before 1914, Canada had produced more railroad men, artisans, nurses, teachers, engineers, writers, actors, doctors, and clergymen than she could profitably employ, but for real or imagined reasons there had been a distinct appetite for their services in the United States, so much so that American employers had the habit of sending agents to, or retaining them in, Canada in order to be sure of a Canadian supply...after the war...Canada began to export, if not the cream, at least the top milk of her population in very large numbers.[6]

The 1950 and 1951 census results of the United States and Canada respectively, as summarized in Table 3, indicate there were higher percentages of Canadian-born in the United States in the professional, managerial, and craftsman categories than there were either Americans in the total United State's labour force or Canadians in the Canadian labour force in these three occupational divisions. Twelve per cent of the Canadian-born in the United States labour force were professional, technical and kindred workers, whereas only 8.7 per cent of the American labour force and 7.5 per cent of the Canadian labour force were in this group. At the other end of the scale, farm labourers and all other labourers comprised 10.4 per cent of the American work force, 15.6 per cent of the Canadian and only 5.4 per cent of the Canadian-born workers in the United States. That concern should have been expressed in Canada in recent years about the loss of well-trained and educated personnel to its southern neighbour, is not surprising. The concern has its roots deeply embedded in history.

Canadian immigration and emigration for the decade 1951 to 1961 are now examined.

Canadian Immigration and Emigration, 1951-1961

In this section recent migration to and from Canada will be examined in terms of the monetary values of the human capital which these movements represent.[7] By so doing, it will be possible to compare the resulting dollar magnitudes with total education expenditures in the economy, gross national product, investment

TABLE 3

OCCUPATIONAL CLASSIFICATION OF UNITED STATES LABOR FORCE, CANADIAN-BORN IN UNITED STATES, AND CANADIAN LABOUR FORCE 1950-1951

	American Labour Force 1950	Canadian-born in U.S.A. 1950	Canadian Labour Force 1951
	(Per Cent)	(Per Cent)	(Per Cent)
Professional, technical and kindred workers	8.7	12.0	7.5
Managers and Proprietors, except farm	8.9	10.6	8.5
Farmers and farm managers	7.7	2.6	10.5
Clerical, sales and kindred workers	19.3	18.5	17.5
Craftsmen, foremen and kindred workers	13.8	18.6	15.9
Operative and kindred workers	19.8	20.7	16.5
Private household workers	2.5	2.3	1.5
Service workers, except private household	7.6	8.3	6.4
Farm labourers and foremen	4.3	1.3	5.1
Labourers, except farm and mine	6.1	4.1	10.5
Occupation not stated	1.3	1.0	.1
	100.0	100.0	100.0

Source: Canada, Dominion Bureau of Statistics: The Canadian-born in the United States. (Ottawa: Queen's Printer, 1956), Tables 12 and 13.

in physical capital, and relevant items in the Canadian balance of international payments.

No attempt will be made to assess the effects of immigration and emigration on factor proportions and production functions employed; on wages, salaries or factor shares; or on external economies and diseconomies. These considerations are important, but are outside the scope of this investigation.

The Approach

The method to be employed here is to calculate the dollar costs of the migrants. Initially, only education costs will be considered. Subsequently, other child-rearing costs as well as the value of migrants' possessions will be included.

A major advantage of using the cost approach for human capital estimates is that physical capital and other items in both the national accounts and international payments records are valued in the same way. Consequently, the human capital magnitudes are easily compared with physical capital values.[8]

The cost method is not without difficulties however. There is the problem of separating the consumption expenditures from the investment outlay that was discussed in the previous chapter. The approach followed here will be to include expenditures on all labour force participants, housewives, and children, with each type of expenditure shown separately. This method serves several purposes. First, it facilitates comparison of the total of these outlays with aggregate educational expenditures. Second, should it be desired, the totals could be adjusted for changing participation rates of housewives in the labour force, or for the age structure of migrants. Finally, other possessions of migrants and also the costs of child-rearing can be introduced so as to arrive at total costs or "values" of migrants. That is, from the viewpoint of educational policy, one can examine only the education costs involved; but if one is thinking in terms of migration policy, then the total value of migrants can be considered.

Ideally, this method should involve calculation of education costs annually for each level of schooling and each type of training, with price indices being used to reduce all years' totals to a comparable basis. Also, detailed yearly costs of child-rearing should be considered. Interest charges on the "investment" in people up to the date of their entry into the labour force should also be taken into account. Mortality rates should be used when arriving at the final "values" of people, especially children who will not be

members of the labour force until some later date. As more complete information becomes available on the education levels of migrants, these refinements hold real possibilities. For now, however, one must be content with a less detailed approach, using rough estimates of the years of education and training possessed by emigrants and immigrants and other costs of child-rearing. Moreover, instead of examining the costs of each year, and allowing for interest charges and mortality rates, estimated replacement costs for a single year will be applied to all people migrating throughout the entire decade.

Immigration and Emigration Figures

The gross immigration and emigration figures employed for the period 1951-1961, classified by intended occupations of the migrants, are presented in Table 4. The immigration data are straightforward and cover all immigrants recorded over the inter-census period of June 1, 1951 to May 31, 1961.[9] The emigration totals, however, require some elaboration. No records on the emigration of her citizens are kept in Canada. Therefore, one must rely on the immigration statistics maintained by other nations. The 1956 United Nations Demographic Year Book indicates that, based on censuses across the world, of the more than one million Canadian-born persons residing outside Canada, approximately 94 per cent lived in the United States and 5 per cent in the United Kingdom; most of the remaining 1 per cent were in Australia and New Zealand. Consequently, information on net Canadian-born emigrants to the United States and the United Kingdom would provide fairly complete coverage of the exodus of such persons from Canada.

The American immigration figures are easily obtainable. The British records are incomplete, however. They indicate only the numbers of immigrants from Canada who travelled by sea. They do not reveal the proportion of these persons who are of Canadian birth; nor do they show the numbers who came by air - and this number may be a substantial proportion of the total.[10] Because of these shortcomings in the British figures, American data have been used exclusively as a measure of gross emigration of Canadian-born persons. Consequently, the figures shown in Table 4, to some extent, understate gross emigration of Canadian-born and the reader should bear this in mind.

The first step in computing the dollar values of migrants is to reduce these gross figures to a net basis; that is, to subtract the number of those persons who returned to their native countries or (as in the case of many overseas immigrants to Canada) who moved to the United States.

TABLE 4
GROSS CANADIAN IMMIGRATION AND GROSS EMIGRATION OF CANADIAN-BORN TO THE UNITED STATES 1951-1961, NUMBERS AND PERCENTAGES IN MAJOR OCCUPATIONAL GROUPS

Immigration to Canada[1]			Emigration of Canadian-born to U.S.A.[2]		
Occupational Group	Number (1)	Per Cent (2)	Occupational Group	Number (3)	Per Cent (4)
Labour Force			Labour Force		
Managerial	9,355	1.1	Managers, officials and proprietors	7,221	5.5
Professional	83,542	10.1	Professional, technical and kindred workers	32,644	25.0
Clerical	75,525	9.2	Clerical and kindred workers	30,098	23.0
Transportation and Communication	18,956	2.3	Sales workers	7,619	5.8
Commercial and financial	30,708	3.7	Private household workers	3,555	2.7
Service	111,641	13.5	Service workers except private household	6,889	5.3
Agricultural	103,044	12.5	Farmers and farm managers	1,998	1.5
Fishing, trapping and logging	7,488	.9	Farm labourers and foremen	1,517	1.2
Mining	8,525	1.0	Craftsmen, foremen and kindred workers	18,059	13.8
Manufacturing, mechanical and construction	258,519	31.3	Operatives and kindred workers	12,203	9.3
Labourers	109,452	13.3	Labourers except mine and farm	8,898	6.8
Others	8,230	1.0			
Sub-Total	824,985	100.0	Sub-Total	130,701	100.0
Percentage labour force is of total immigrants		53.5	Percentage labour force is of total emigrants		45.7
Non-Labour Force			Non-Labour Force[3]		
Wives	292,818	40.8	Wives	59,080	38.2
Children	371,580	51.8	Students	13,993	8.8
Others	53,470	7.4	Children under 14	74,628	48.4
			Others	7,773	4.6
Sub-Total	717,868	100.0		155,474	100.0
TOTAL	1,542,853			286,175	

Sources: Immigration: Canada, Department of Citizenship and Immigration, Immigration: 1955-1962.
Emigration: U.S., Department of Justice, Immigration and Naturalization Service, Annual Reports; 1951-1962 (Washington: Government Printing Office).

Notes: [1] Data covers from June 1, 1951 to May 31, 1961.
[2] Data covers from July 1, 1951 to June 30, 1961.
[3] No record is kept in U.S.A. of the detailed categories of non-labour force Canadian-born, immigrants. However, for recent years there is such a breakdown for all emigrants from Canada to U.S.A. The percentages shown of (i) housewives, (ii) students, (iii) children under 14, and (iv) other, are based on these figures for the period 1956-1961. The absolute numbers in these four categories were obtained by applying these percentages to the total of Canadian-born, non-labour force, emigrants to U.S.A. during the period July 1, 1951 to June 30, 1961.

Immigration. Complete and accurate data on immigrants who later returned home are impossible to obtain. Canadian Census data for 1951 and 1961 are therefore used to supplement annual gross immigration data.[11] Analysis of the 1961 Census indicates that, from June 1, 1951 to May 31, 1961, of the 1,543,000 immigrants 1,160,000 were shown as residents in 1961 - implying a decline of 383,000 persons. After allowing for mortality and making several other adjustments necessary to reconcile census definitions with immigration records, it appears that some 355,000 immigrants left Canada again during the Census period;[12] that is, of all inter-census immigrants, 23 per cent left Canada. Consequently, immigration figures from Table 4 are reduced by this percentage in arriving at net immigration for the inter-census period.

Perhaps different percentages should be applied to each occupational category because of variations in the propensities of these people to return home or move on to the United States. For example, those in the professional-managerial categories might find it easier financially to leave if they did not like their surroundings, while it could be that the unskilled might have difficulty in obtaining work and consequently would be the ones most likely to return home or move on. Lacking any evidence on the tendencies of the different occupational groups to re-emigrate the same proclivity for each group has been assumed.

One might contend that many of the immigrants have to be taught a new language and be guided considerably in their adjustment to new surroundings, and that this type of education cost should be charged against any gains to Canada from acquiring these people - this would seem especially true for the 23 per cent of inter-census immigrants who left Canada. Several years of training and education may have been invested in them or in their Canadian-born children. Perhaps, therefore, some further factor of reduction beyond the 23 per cent used above should be allowed.

Alternatively, however, one might contend that because new immigrants are anxious to better themselves and avoid being a charge on society, they will probably work harder than most citizens while employers, taking advantage of their status as new Canadians, may pay them somewhat less than their marginal product. If this view is correct, the excess of their marginal product over the remuneration that they receive may equal or exceed the costs borne by society in teaching immigrants a new language and, similarly, in providing training and education for those who emigrate again later. The extent to which these considerations

may cancel out one another is not known and therefore no allowance has been made for them.

Emigration. Only Canadian-born emigrants are being considered here. In the emigration data all other migrants from Canada must have been immigrants to Canada at some earlier date and would be accounted for in the figures to reduce gross immigration to a net figure.

Even with this simplification, net emigration statistics are not easily determined. There are at least four different figures to consider:

(a) the gross number of 286,175 shown in the records of the United States Immigration and Naturalization Service for the period July 1, 1951 to June 30, 1961. (See Table 4);

(b) this total reduced by the 47,345[13] Canadians recorded as returning to Canada from 1951 to 1961, i.e., a net figure of approximately 239,000;

(c) the figure of 135,000 arrived at through use of American Census data and mortality tables;[14]

(d) the figure of approximately 55,000 obtained from analysis of Canadian Census data.[15]

The first figure is obviously too high, as some Canadians are bound to have returned to Canada. The second figure of 239,000 that allows for over 47,000 returning citizens is somewhat more realistic. It too, however, can be questioned.

The number of Canadian citizens returning to the country can also include those of foreign birth as well as those of Canadian birth. For this reason, the figure of 47,000 may be too high. Alternatively, due to the very large increase in traffic across the Canadian-American border, detailed form-filling tends to be avoided unless there is some legal requirement necessitating it. Therefore, the figure of 47,000 may underestimate the number of Canadian-born returning to Canada. To what extent these influences cancel one another out is not known. However, as will be indicated later in the discussion, the figure of 47,000, as an estimate of returning Canadian-born emigrants, is probably on the low side; conversely, the figure of 239,000 will probably overstate net emigration. Nevertheless, this latter figure is used as a maximum net estimate of the emigration of Canadian-born.

Either the figure of 135,000 based on data from the American Census or the figure of 55,000 derived from the Canadian Census could be used as a minimum net estimate of Canadian-born emigrants.

The figure of 55,000 for net emigration obtained from analysis of the Canadian census data is questionable. It implies that four out of every five Canadian-born persons leaving the country return to Canada. It also implies that only one of about every five Canadians returning to Canada are recorded as doing so in migration statistics. The real difficulty is that the emigration figure is a residual left after all other adjustments have been made in the census information, and it reflects the sum total of all errors that may arise in other calculations relating to mortality, immigration, and completeness of enumeration. Furthermore, the emigration of Canadian-born is a residual of total emigration. A few examples of the types of errors that could occur will clarify the problem.

For the 1961 Census it has been assumed that the percentage-coverage of the enumeration was equal to that of 1951. It has been said that even if there was a smaller percentage of omissions in 1961, there was a larger population base so that the two effects would cancel out.[16] However, this would be unlikely.

If there were a 1 per cent increase in completeness of the enumeration in 1961, then although with a larger population base, the absolute numbers missed in the 1961 Census may be about the same as in the 1951 Census, the 1 per cent existing in 1951 and not counted then would be counted in 1961. With a population base of 14,000,000 people in 1951, this would mean 140,000 additional persons picked up in 1961 that were not included in 1951. This figure would, of course, have to be reduced for mortality; but allowing for this, there would still be about 115,000 new people added to the rolls. This in turn would cause the residual emigration category to show 115,000 fewer people departing the country than was actually the case. There is every chance that this may have occurred.

The number of Canadian-born emigrants may also be reduced below what it should be, due to the tendency of new Canadians (striving to become assimilated) to say that they were born in Canada when enumerated in the 1961 Census. This would increase the number of new Canadians who are assumed to have emigrated during the inter-census period (thereby reducing net immigration) and consequently would reduce the residual of Canadian-born emigrants. That this is a real possibility indicated by a 2 per

cent re-enumeration of households in the October 1961 Labour Force Survey by regular Dominion Bureau of Statistics staff.[17] The interviewers did not tell the people that they had the former reports until after the enumeration when a comparison was made and discrepancies were reconciled. This study revealed that of the group age 14 and over that was surveyed, 0.4 per cent declared themselves non-immigrants in the original Labour Force Survey, but in the re-survey admitted to being immigrants who had arrived between 1954 and 1961. The tiny size of this sample prevents us from drawing any firm conclusions. However, the results do indicate a tendency by immigrants to claim Canadian birth and this in turn reduces estimated net emigration. If, for example, the above percentage were applied to the entire population at the census date, it would appear that nearly 73,000 more immigrants had departed the country than actually occurred. This would reduce the number of residual Canadian-born emigrants by the same amount. Notice, too, this estimate makes no allowance for those new Canadians who, even on the second enumeration, said they were born in Canada.

For these several reasons, then, one is reluctant to accept the residual figure of only 55,000 Canadian-born emigrants to the United States for the period under discussion.

The total of 135,000 appears to be a more likely figure to use as a minimum estimate of emigration of people of Canadian birth. It is obtained by comparing the observed decline in Canadian-born in the United States between their 1950 and 1960 Censuses with the larger decline which should have occurred due to the deaths of Canadian-born residents in the United States during this period. The difference, 135,000, is an estimate of the number of new Canadian-born who must have entered the United States between their Censuses.[18] If allowance of 1 per cent is made for an improvement of coverage in enumeration of Canadian-born in America in the 1960 Census, this difference would be reduced by about 10,000. On the other hand, if there is a tendency for the Canadian-born to deny their Canadian origin (as immigrants to Canada also tend to do), then probably this would more than offset the 10,000 reduction due to improvement in enumeration coverage. Consequently, the 135,000 figure will be accepted as a crude minimum estimate of Canadian-born emigrants to the United States.

Briefly then, of the four approximations to the number of Canadian-born emigrants to the United States during the inter-census period June 1, 1951 to May 31, 1961, the second (239,000) will be employed as a maximum estimate, and the third (135,000) as a minimum estimate. This means that we shall reduce the

gross emigration data in Table 4 by two percentages - 16.5 and 52.8 - to arrive at net emigration figures. As with the case of immigrants, we shall assume that each occupational group is affected proportionately.

The preceding discussion of emigration statistics will enable the reader to make his own qualifications about the calculations and observations on the costs to Canada of emigration which follow. It also demonstrates the need for better emigration statistics.

The Years of Education and Training - Immigration and Emigration

No exact information is available on the education level of immigrants or emigrants. Therefore, it is assumed that migrants have an education equal to the mean schooling possessed by Canadians, at the time of the 1961 Census, in each relevant occupational group. Housewives are assumed to have an education equal to the mean education of women of the 1961 Canadian labour force, and all children are assumed to have four years of schooling. The education level used for "others" is equal to the mean of all other occupational groups (excluding children) taken together.

Using this approach the mean level of general education of emigrants, excluding children, is 10.2 years, whereas the level for the Canadian labour force, calculated in the same manner, is 9.2 years. This figure therefore indicates that, a more than proportionate number of emigrants have been from the better-educated segments of the labour force.

It may be argued that, by assuming immigrants' educational levels to be equal to those of Canadian labour force participants in similar occupational groups, the education of immigrants is being over- or under-estimated. However, a comparison with a study of citizenship applicants in 1959 indicates that this is not the case.[19] The average general education (i.e., excluding vocational training) of immigrants (excluding children) computed by the present method is 9.0 years. The mean years of schooling of the 1959 citizenship applicants was 9.1 years. The study also states that the results can be viewed as quite representative for post-war immigration. Therefore, the method used here tends to slightly undervalue the level of education of immigrants, if anything. In support of this view, there are several studies indicating that immigrants are capable of progressing to occupations requiring more education than those mentioned in their original intentions. For example, one inquiry indicated that whereas only 0.9 per cent

of the immigrants from 1951-1961 presented themselves as planning to take up managerial occupations, 6.8 per cent were in such occupations at the time of the 1961 Census.[20]

Another question is whether foreign rather than Canadian educational levels should be used for immigrants. If the number of years of education that foreigners obtained in their own countries was used as a standard, it could result in people, who came from various nations, working in the same occupation and conceivably with the same level of skill, being valued differently simply because the standards of their native educational systems differed. For example, it may take a resident in one land longer to become a qualified physician than in other lands. This would be an unsatisfactory situation. Consequently from this viewpoint use of Canadian educational levels would appear advisable.

Alternatively, however, if the titles of various occupations are the same in Canada and abroad, yet the levels of competence required of students to qualify for such titles vary widely among countries, it would then be wrong to use domestic ratings to measure the value of immigrants. Members of each occupation from every country would have to be considered separately. Indeed, this is the ideal. However, the information available does not permit such an approach. Therefore, Canadian educational levels are used in valuations of all immigrants.

Vocational training must also be considered. In practice, it would be difficult to separate such training from general education since both are frequently acquired at the same time. However, in the present study, it is assumed that vocational training is acquired in addition to general education, and separate estimates are made of such training possessed by migrants.[21]

The basic reference used is Estimates of Workers Trait Requirements for 4,000 Jobs, which specifies training times necessary for average performance in each occupation covered,[22] is the basic reference used. The specified training times have been related to the occupational categories shown in the immigration and emigration statistics. The resulting estimates might be somewhat low for some immigrants, particularly those from Europe where apprenticeship and vocational training may involve as much as five years training, but taking immigrants as a whole the figures are probably accurate.

The estimates of general education and training for immigrants and emigrants are summarized in Tables 5 and 6, which are self-explanatory. It will be seen that immigrants for the

TABLE 5
ESTIMATED YEARS OF EDUCATION OF IMMIGRANTS
1951-1961

	Numbers Reduced by Immigrants Leaving (1)	Estimated Education and Training			Total Years of Education (5)
		Estimated Education (Mean Years) (2)	Training (Mean Years) (3)	Total (Mean Years) (Col. 2 + Col. 3) (4)	
Labour Force					
Managerial	7,203	10.4	5.0	15.4	110,926
Professional	64,327	13.3	3.5	16.8	1,080,694
Clerical	58,154	10.8	.6	11.4	662,956
Transportation and communication	14,596	8.7	.4	9.1	132,824
Commercial and financial	23,645	10.1	.6	10.7	253,002
Service	85,964	8.4	.5	8.9	765,080
Agricultural	79,344	7.2	.2	7.4	587,146
Fishing, trapping and logging	5,766	6.2	.2	6.4	36,902
Mining	6,564	7.6	2.4	10.0	65,640
Manufacturing, mechanical and construction	199,060	8.0	1.9	9.9	1,970,694
Labourers	84,278	7.2	-	7.2	606,802
Others	6,337	8.7[1]	1.2[2]	9.9	62,736
Sub-Total	635,238				6,335,402
Non-Labour Force					
Housewives	225,470	9.8	-[3]	-	2,209,606
Children	286,117	4.0	-	4.0	1,144,468
Others	41,172	8.7[1]	1.2[2]	9.9	407,603
Sub-Total	552,759				3,761,677
TOTAL	1,187,997				10,097,079

Sources: Column (1) = Col. (1) Table 4 x .77; .77 = the estimated proportion of total immigrants who stay in Canada.
Column (2) Estimated from 1961 Census of Canada Vol. III, Part 1, Labour Force: Occupations by Sex, Showing Age, Marital Status and Schooling (Ottawa: Queen's Printer).
Column (3) United States, Department of Labor, Bureau of Employment Security, United States Employment Service. Estimates of Worker Trait Requirements for 4,000 Jobs; and also 1961 Census of Canada, Labour Force: Occupations by Sex....
Column (4) = Col. (2) + Col. (3).
Column (5) = Col. (4) x Col. (1).

Notes: [1] Mean education level for immigrant labour force without this category.
[2] Mean training time for immigrant labour force without this category.
[3] No special training was assumed for housewives of immigrants.

TABLE 6
ESTIMATED YEARS OF EDUCATION OF CANADIAN-BORN EMIGRANTS TO UNITED STATES
1951-1961

	Numbers Reduced by Emigrants Returning		Estimated Education and Training			Total Years of Education and Training	
	Using 83.5% (1a)	Using 47.2% (1b)	Estimated Education (Mean Years) (2)	Training (Mean Years) (3)	Total (Mean Years) (Col. 2 + Col. 3) (4)	Using 83.5% (5a)	Using 47.2% (5b)
Labour Force							
Managers, officials and proprietors	6,030	3,408	10.4	5.0	15.4	92,862	52,483
Professional, technical and kindred workers	27,258	15,408	13.3	3.5	16.8	457,934	258,854
Clerical and kindred workers	25,132	14,206	10.8	.6	11.4	286,505	161,983
Sales workers	6,362	3,596	10.0	.5	10.5	66,801	37,758
Private household workers	2,968	1,678	8.1	.4	8.5	25,228	14,263
Service workers except private household	5,752	3,252	8.8	.5	9.3	53,494	30,244
Farmers and farm managers	1,668	943	8.0	5.0	13.0	21,684	12,259
Farm labourers and foremen	1,267	716	7.4	.2	7.6	9,629	5,442
Craftsmen, foremen and kindred workers	15,079	8,524	8.1	1.8	9.9	149,282	84,388
Operatives and kindred workers	10,190	5,760	7.8	.7	8.5	86,615	48,960
Labourers except mine and farm	7,430	4,200	7.2	-	7.2	53,496	30,240
Sub-Total	109,136	61,691				1,303,530	736,874
Percentage of immigration totals	17.2	9.7				20.1	11.7
Non-Labour Force							
Housewives	49,332	27,886	9.8	1.1	10.9	537,719	303,957
Students	11,684	6,605	12.0	-	12.0	140,348	79,260
Children under 14	62,314	35,224	3.0	-	3.0	186,942	105,672
Others	6,490	3,669	10.2[1]	1.8[2]	12.0	77,880	44,028
Sub-Total	129,820	73,384				942,889	532,917
TOTAL	238,956	135,074				2,246,419	1,269,791
Percentage of immigration totals	20.1	11.4				22.2	12.6

Sources: Column (1a) = Col. (3) Table 4 x .835; .835 = the maximum proportion of total emigrants estimated to remain in the United States;
Column (1b) = Col. (3) Table 4 x .472; .472 = the estimated minimum proportion of emigrants remaining in United States.
Column (2) Estimated from 1961 Census of Canada, Vol. III, Part 1, Labour Force: Occupations by Sex, Showing Age, Marital Status and Schooling. (Ottawa: Queen's Printer).
Column (3) United States, Department of Labor, Bureau of Employment Security, United States Employment Service, Estimates of Workers Trait Requirements for 4,000 Jobs; and also 1961 Census of Canada, Labour Force: Occupations by Sex....
Column (4) = Col. (2) + Col. (3).
Column (5) = Col. (4) x Col. (1).

Notes: [1] Average (mean) education level for emigrant labour force without this category.
[2] Average training time for emigrant labour force without this category.

ten-year period 1951-1961 represent about 10,100,000 years of education and training, whereas Canadian-born emigrants account for either 2,200,000 or 1,300,000 years of education and training depending upon which emigration estimate is used.

The emigrant labour force (using the high estimate) was numerically 17.2 per cent of the immigrant workers, but after allowing for the difference in education and training of both groups, emigrants equalled 20.1 per cent of immigrants. When non-labour force persons are included, the corresponding percentages are 20.1 and 22.2 respectively. (If the low estimate for emigration is used, the proportions are about 57 per cent as large in each case, but the same general relationships prevail.)

The Costs of Education and Training

Costs of education are estimated using the approach developed by Schultz. The three main components of these costs are:

(i) institutional outlays for current expenses, plus implicit interest and depreciation;[23]

(ii) opportunity costs;

(iii) incidental expenses of attending school such as books, supplies, and additional transportation.

The rationale for including such outlays in cost calculations was discussed in Chapter 1. Summary figures of annual outlays per student for each type of schooling are presented in Table 7. Total education costs represented by immigrants and emigrants are presented in Table 8.

A number of highlights of the latter table deserve special mention. Consider first the high estimate of emigration of the Canadian-born. In absolute numbers the emigrant labour force equals 17.2 per cent of immigrants. But when education costs are considered, the figures for emigration total 26.6 per cent of those for immigration. If housewives, children, and others are included, the corresponding figures are 20.1 per cent and 29.4 per cent. If we use the low estimate of emigration, then in absolute numbers, the emigrant labour force totals 9.7 per cent of the immigrant labour force. In terms of dollar education costs, the figures for emigrant workers equal 15.0 per cent of those for immigrant workers, and when non-labour force migrants are also considered, the corresponding percentages are 11.4 and 16.6.

TABLE 7
AVERAGE ANNUAL COST PER STUDENT BY TYPE OF SCHOOLING

School Level	Institutional Costs (1)	Earnings Foregone (2)	Incidental School Costs (3)	Total Cost per Year (4)
Elementary school	253	-	-	253
High school	522	855	43	1,420
College or university	1,891	1,943	155	3,989
Vocational training	1,050	1,400	100	2,550

Sources:

Column (1), line (1): Total elementary school costs Col. (9), line (1), Appendix 2, Table A / Total students in elementary schools, 1959-1960

$\frac{\$834 \text{ millions}}{3.3 \text{ millions}} = \$253$ per student.

Column (1), line (2): Total secondary school costs Col. (10), line (1), Appendix 2, Table A / Total students in secondary schools, 1959-1960

$\frac{\$383 \text{ millions}}{.73 \text{ millions}} = \$522$ per student.

It is of interest to note that total expenditures on public elementary and secondary education per pupil of average daily attendance for 1960 were estimated at $348 for both types taken together in Dominion Bureau of Statistics, Education Division, Survey of Education Finance: 1959-1960 (Ottawa: Queen's Printer, 1963), Table 13.

Also, the above estimates correspond roughly to costs of education per student calculated by the Ontario Department of Education for the years 1958 and 1960. These were as follows:

	1958	1960
Elementary school costs per pupil of average daily attendance	$242	$281
Secondary school costs per pupil of average daily attendance	$524	$622

Report of the Minister of Education, 1963, Ontario, Table 91.

Column (1), line (3): Total university costs Col. (8), line (2) Appendix 2, Table A / Total university students, 1959-1960

$= \frac{\$191 \text{ millions}}{101 \text{ thousands}} = \$1,891.$ This seems an almost exorbitant amount, yet even without allowance for implicit interest and depreciation, the costs are $1,300 per student.

Furthermore, in reply to a question by Mr. Orlikow in the Canadian House of Commons, April 22, 1964, the cost per year of educating mathematicians and engineers at university for the 1963-1964 year, excluding implicit depreciation was estimated as follows:

Mathematicians $1,225
Engineers $1,800

TABLE 7 (Concluded)

Column (1), line (4): While figures are available for the total money the provincial and federal governments put into vocational training (which totalled $53 million for 1960), these expenditures cover costs of training in trade schools, post-secondary technical courses, a share of industry-sponsored training, apprenticeship programs and so on. To be correct, one should compute the cost per year of each type of vocational training. But because any one of several of these types of training might be used by a person to gain accreditation in many occupations, and each type would involve different costs, it would still be difficult to determine which cost level should be employed. Thus, a much simpler procedure will be used, namely, vocational training costs per pupil will be assumed to be twice the high school cost or $1,050. This is still well below the cost of a year at university. It seems logical that the cost of vocational training would be somewhere in this range because normally such training involves more equipment and lower pupil-teacher ratios than high school education, yet is not as advanced as most university training.

Column (2), lines (1), (2), and (3): No opportunity costs are assumed for elementary school students. At the time these computations were made, 1961 Census data for Canada from which opportunity costs might be calculated were not available. Hence the figures Schultz developed for the United States for 1956 were used instead: see "Capital Formation...", Table 2, Col. (3) and (5). The Canadian Census figures now available from a special run indicate that these figures are not far out: for high school students, the average opportunity costs are about $900; and for university students age 20-24 the opportunity costs less summer earnings are about $2,200. Since these latter figures are slightly higher than those used above, the effect of employing them would have been to increase the dollar value of emigrants relative to immigrants. This follows because there appears to be a larger proportion of emigrant workers with secondary and higher education than there are immigrant workers with these levels of schooling.

Column (3), line (2): Schultz used a figure of 5 per cent of total earnings foregone to cover expenditures for books, supplies, extra clothes and travel to and from school. This amounts to $43 per high school student, which seems adequate.

Column (3), line (3): Whereas Schultz used 10 per cent of earnings foregone, which in this case would amount to $195 per student, the figure employed here is 8 per cent or $155, which is much more in line with the estimates of such costs presented in D. B. S., Education Division, University Student Expenditure and Income in Canada: 1961-1962, Part II (Ottawa: Queen's Printer, 1963).

Column (3), line (4): A figure half way between high school and university costs has been used here.

Column (4) = Col. (1) + Col. (2) + Col. (3).

TABLE 8
ESTIMATED EDUCATION COSTS OF IMMIGRANTS TO CANADA AND CANADIAN-BORN EMIGRANTS TO UNITED STATES
1951-1961

Canadian-Born Emigrants to United States				Immigrants to Canada		
		Total Cost Per Occupation (Thousands of Dollars)				
Occupation	$ Cost Per Individual (1)	High Estimate (2a)	Low Estimate (2b)	Occupation	$ Cost Per Individual (3)	Total Cost Per Occupation (Thousands of Dollars) (4)
Managers, officials and proprietors	18,182	109,637	61,964	Managerial	18,182	130,965
Professional, technical and kindred workers	21,815	594,633	336,126	Professional	21,815	1,403,294
Clerical and kindred workers	7,530	189,244	106,971	Clerical	7,530	437,900
Sales workers	6,139	39,056	22,076	Transportation and communication	4,038	58,939
Private household workers	3,186	9,456	5,346	Commercial and financial	6,536	154,544
Service workers except private household	4,435	25,510	14,423	Service	3,867	332,423
Farmers and farm managers	14,774	24,643	13,932	Agricultural	2,332	185,030
Farm labourers and foremen	2,382	3,018	1,706	Fishing, trapping and logging	2,079	11,988
Craftsmen, foremen and kindred workers	6,756	101,874	57,588	Mining	8,043	52,794
Operatives and kindred workers	3,758	38,294	21,646	Manufacturing, mechanical and construction	6,869	1,367,343
Labourers except mine and farm	1,822	13,537	7,652	Labourers	1,822	153,555
				Others	6,078	38,516
Sub-Total		1,148,902 = 26.6% of Immigration Costs	649,340 = 15.0% of Immigration Costs	Sub-Total		4,327,291
Housewives	7,385	364,317	205,938	Housewives	4,580	1,032,653
Students[1]	7,704	90,029	50,885	Children	1,012	289,550
Children under 14	1,012	63,062	35,647	Others	6,078	250,243
Others	9,738	63,200	37,727			
Sub-Total		584,608	330,197	Sub-Total		1,572,446
TOTAL		1,733,510 = 29.4% of Immigration Costs	979,537 = 16.6% of Immigration Costs	TOTAL		5,899,737

Sources: Column (1) and (3): See Appendix 2, Table B, Col. (5).
Column (2a) = Col. (1) x Col. (1a), Table 6.
Column (2b) = Col. (1) x Col. (1b), Table 6.
Column (4) = Col. (3) x Col. (1), Table 5.

Note: [1] Grade 12 assumed.

Also, when either the high or low emigration figures are used, the professional, technical and managerial groups comprise 25.6 per cent of the absolute numbers of emigrants but 40.6 per cent of the education cost of these migrants.

The absolute dollar amounts involved are also of considerable significance. For example, the total education cost of net immigration for the inter-census decade 1951-1961 was $5,900 million. One-tenth of this amount ($590 million) equals 36 per cent of the aggregate expenditures of $1,622 million for education in the year 1960. It is also equivalent to 1.6 per cent of the gross national product of $35,925 million for the same year. The total education cost of net emigration of Canadian-born persons to the United States for this period amounted to either $1,734 million or $980 million depending upon whether the high or low estimate of emigration is used; the average values per year are $173.4 million and $98 million, and they equal 10.7 per cent and 6.0 per cent, respectively of formal education expenditures in 1960.

The net education value of immigrants less Canadian-born emigrants for the decade ranges between $4,167 and $4,920 million according to whether the high or low estimate is used. The average of these two extremes, $4,544 million, is nearly 52 per cent of the monetary capital inflow to Canada during this ten-year period.[24] One-tenth of this average net value ($454 millions), is 102 per cent of new issues of Canadian securities during 1960, and 70 per cent of total foreign, direct investment in Canada for the same year. Clearly the magnitude of this net inflow of human capital formed through educational outlays is very significant in comparison to the inflow of monetary capital.

Other cost items associated with the movement of people across the Canadian borders are now examined. These include other outlays for child-rearing, migrants' funds, and settlers' effects.[25]

Other Cost Items

Settlers' Effects and Migrants' Funds. Settlers' effects are the physical assets that migrants take with them or have transferred at the time of their migration. Migrants' funds include the money possessed by migrants when moving, together with later transfers of money.[26] These two types of costs are presented, along with education costs, in Table 9.

It will be seen that when such costs are included, and the high estimate for emigration is considered, total emigration as a

TABLE 9
EDUCATION COSTS, MIGRANTS' FUNDS AND SETTLERS' EFFECTS OF IMMIGRANTS TO CANADA AND CANADIAN-BORN EMIGRANTS TO UNITED STATES
1951-1961

	All Migrants	
	Using High Emigration Estimate	Using Low Emigration Estimate
	Millions of Dollars	
Immigration:		
Education value	5,900	5,900
Immigrants' funds[2]	177	-13
Settlers' effects[3]	124	71
	6,201	5,958
Emigration:		
Education value	1,734	980
Emigrants' funds[1]	436	246
Settlers' effects[4]	80	27
	2,250	1,253
Emigration as a percentage of Immigration	36.2%	21.0%

Source: Table 8 and Dominion Bureau of Statistics, National Accounts and Balance of Payments Division.

Notes: [1] Estimated transfers of funds by emigrants for calendar years 1951-1960 inclusive total $911 million. Average per capita funds transferred by Canadian-born emigrants is estimated by D.B.S. to be about $1,875. For 286,175 such emigrants the total funds involved would be $522 million. To allow for returning Canadian-born, it has been assumed that these persons would have the same funds as emigrants. The amount of $522 million has then been reduced by 16.5 per cent and 52.8 per cent respectively in accordance with the high and low estimates for net Canadian-born emigrants: the results are $436 million and $246 million.

[2] Estimated immigrants' funds for calendar years 1951-1960 inclusive were $747 million. This includes a D.B.S. estimate of approximately $95 million for Canadians returning from the United States. Therefore, net receipts attributable to non-Canadian immigrants are $652 million. From this total must be deducted the funds of immigrants who emigrate again. These will be about equal to the $911 millions of total emigrants' funds less those attributed to Canadian-born emigrants of $436 and $246 million (using the high and low estimates for Canadian-born emigrants). The figures for funds of immigrants emigrating are therefore $475 million and $665 million respectively. These totals are deducted from $652 million of receipts to arrive at net receipts from immigrants of $177 million and minus $13 million.

[3] Immigrants' effects per capita are estimated to be 24 per cent as great again as estimated emigrants' effects per capita. (This is the ratio that immigrants' funds per capita bear to emigrants' funds per capita.) The number of immigrants during the decade (1,543,000) were weighted by this percentage to arrive at an "equivalent value" of emigrants of 370,000. Total migrants entering during the decade using the low estimate for returning Canadian-born (47,000)

TABLE 9 (Concluded)

is 417,000. Therefore, the proportion of recorded settlers' effects of migrants into Canada attributable to Canadian-born persons is 47/417 = 11.3 per cent. Hence, 11.3 per cent of $299 millions of settlers' effects = $34 million for Canadian-born returning to Canada. Using our high estimate of returning Canadian-born of 151,000, the proportion that Canadian-born is of the total = 151/521 = 29 per cent. Hence, 29 per cent of $299 million = $87 million attributable to Canadian-born returning.

Therefore:

Receipts of immigrants' settlers effects are:

	Using High Estimate of Returning Canadian-born of 151,000 (i.e., low estimate of net emigration)	Using Low Estimate of Returning Canadian-born of 47,000 (i.e., high estimate of net emigration)
	(millions of dollars)	
Recorded immigrants' effects	299	299
Less effects of returning Canadian-born	87	34
	212	265
Less loss due to immigrants emigrating (see note 4)	141	141
	71	124

[4] Losses of settlers' effects due to emigration = $255 millions. It is assumed per capita assets of Canadian-born emigrants and of former immigrants now emigrating are the same. Then, the $255 millions are divided among these two groups in proportion to the numbers of persons involved:

Canadian-born gross emigrants	= 286,000	= 44.6 per cent
Immigrants emigrating	= 355,000	= 55.4 per cent
	641,000	100.0

Thus: Assets of Canadian-born emigrants = 44.6 per cent of $255 millions = $114 millions

Assets of immigrants emigrating = 55.4 per cent of $255 millions = $141 million

$255 million

Net loss of settlers' effects due to emigration of Canadian-born is $114 millions less effects gained by estimated returning Canadian-born (see note 3), of $87 millions for the high estimate of returning Canadian-born or $34 millions for the low estimate of returning Canadian-born. Net figures for the two possibilities are $27 million and $80 million respectively.

percentage of total immigration is 36.2 per cent compared to 20.1 per cent in terms of absolute numbers. With the low emigration estimate the value of all emigrants rises from 11.4 per cent in absolute numbers to 21.0 per cent of immigration.

It is also interesting that although numerically emigration was between 11 and 20 per cent of immigration, the estimated value of emigrants' assets was $215 million greater than the estimate of immigrants' possessions. This phenomenon may be in part due to the fact that 30.6 per cent of emigrant workers were in the professional and managerial categories (where incomes are generally higher) whereas only 11.3 per cent of the immigrant labour force were in these groups. Also, the lower income levels in Europe and the United Kingdom - the sources of most immigrants - will be partially responsible. Furthermore, exchange restrictions have undoubtedly been significant in limiting the amounts that immigrants have been able to transfer.[27]

Costs of Child-Rearing. Costs of raising children[28] include items such as food, clothing, housing, medical care, and entertainment. Examination of two independent studies of these costs for a child indicates that an annual allowance of $650 is appropriate.[29] No allowance has been made for the living costs of persons after 14 years of age. This assumes that the provision for foregone earnings of high school, vocational school, and college students in the earlier calculations of education costs would be about equal to the living expenses of these persons. For migrants less than 14 years of age, we assume an average age of 8. The total outlays involved for child-rearing and other costs associated with the migration are presented in Table 10.

The aggregate replacement cost-outlays represented by net immigration to Canada during the inter-census decade 1951-1961 are more than $15 billion. Replacement cost value of net emigration of Canadian-born to the United States is between $2.25 billion and $4 billion. The net gain to Canada from total migration is therefore between $11.2 billion and $12.8 billion or, taking the average, $12 billion. This total equals 137 per cent of the aggregate net capital inflow over the ten calendar years 1951-1960. If we take one-tenth of this figure as the annual average worth to Canada of net migration (that is, $1.2 billion), it equals 186 per cent of all direct foreign investment in the country during 1960 - the year when direct investment totalled $645 million (the highest for any year of the preceding decade). The annual average of $1.2 billion also equalled 3.3 per cent of the gross national product for 1960. Net migration clearly has been an important source of

human, and so far as settlers' effects and migrants' funds are concerned, physical and monetary, capital to the Canadian economy in the decade beginning in mid-1951.

TABLE 10
ALL COSTS OF IMMIGRANTS TO CANADA
AND CANADIAN-BORN EMIGRANTS
TO UNITED STATES
1951-1961

	All Migrants	
	Using High Emigration Estimate	Using Low Emigration Estimate
	(millions of dollars)	
Immigration:		
Costs excluding child-rearing	6,201	5,958
Child-rearing costs	9,109	9,109
	15,310	15,067
Emigration:		
Costs excluding child-rearing	2,250	1,253
Child-rearing costs	1,817	1,027
	4,067	2,280
Emigration as a percentage of immigration	26.5	15.1

Source: Table 9; also see Footnote 29.

Some Concluding Observations

In Table 11 we summarize the changing percentages (emigration of immigration) when all the different cost items are introduced. Because the expenditures for raising children are common to both immigrants and emigrants and are large in relation to the other costs calculated, the effect of adding them to the other dollar values is to reduce somewhat the percentage which emigration is of immigration. Despite this reduction, however, when all dollar values are considered instead of just absolute numbers of persons, emigration (using the high emigration estimate) rises from 20.1 per cent to 26.5 per cent of immigration; that is emigration as a proportion of immigration increases by about one-third when the value of the education invested in migrants, child-rearing costs, and migrants' possessions are considered. A similar conclusion is reached when the low estimate of emigration is employed.

TABLE 11
EMIGRATION AS A PERCENTAGE OF IMMIGRATION
1951-1961

Method of Comparison	Using High Estimate for Emigration	Using Low Estimate for Emigration
	(per cent)	
(a) Absolute numbers	20.1	11.4
(b) Years of education and training	22.2	12.6
(c) Costs of education and training	29.4	16.6
(d) Costs as in (c) plus settlers' effects and migrants' funds	36.2	21.0
(e) Same as (d) plus costs of child-rearing	26.5	15.1
Percentage increase of emigration as a proportion of immigration when all costs are introduced	31.8	32.5

Source: Tables 4, 6, 7, 8, 9 and 10.

An implication of this relationship is that if occupational status and relative levels of wealth of migrants remain unaltered, but the absolute numbers of migrants changed until net emigration is about three-quarters of net immigration, Canada would have a "balance" in dollar terms from migrant flows, rather than experiencing a gain as in the 1951-1961 decade. If net emigration became more than three-quarters of immigration, a loss would be incurred.[30]

We shall not attempt to derive policy proposals from these observations; limitations of space prohibit such an endeavour. Also, very much more research would be necessary before well-defined and consistent immigration and emigration policies could be formed. However, it should be evident from the above study that it is important to look beyond the absolute numbers of persons involved in international migration and consider the dollar values of the human capital flows as well. Only in this way could we hope to arrive at any realistic assessment of the dollar gains and losses involved.

Footnotes

[1]Canada, Dominion Bureau of Statistics, Canada Year Book: 1957-58, p. 160; R.H. Coats, "Canada," International Migrations, Vol. II: Interpretations, National Bureau of Economic Research, New York, N.Y., 1931, pp. 123-142; and Duncan M. McDougall, "Immigration into Canada, 1851-1920," Canadian Journal of Economics and Political Science, 27 (May, 1961), pp. 162-175.

[2]Marcus Lee Hansen and John B. Brebner, The Mingling of the Canadian and American Peoples (New Haven: Yale University Press, 1940), provides an excellent historical account of these movements: see also, Canada Year Book: 1957-58, pp. 154-164.

[3]McDougall differs sharply with the DBS figures on this decade and suggests that both immigration and emigration were about 500,000 less than the DBS data indicate.

[4]Canada, Dominion Bureau of Statistics, The Canadian-Born in the United States (Ottawa: Queen's Printer, 1956), p. 15.

[5]The Canadian-Born in the United States: An Analysis of the Statistics of the Canadian Element in the Population of the United States: 1850 to 1950 (New Haven: Yale University Press, 1945), pp. 200-215. Note also that the problem of losing well-educated and skilled people is not one limited to Canada alone; Britain faces similar difficulties as indicated by Sir Roy Harrod in The British Economy (New York: McGraw-Hill, 1963), pp. 69-70.

[6]The Mingling . . . , pp. 261-262.

[7]It would have been useful to apply a similar approach to migration of earlier decades, but the occupational detail is not sufficient to justify such a project.

[8]For further discussion of this, and of other reasons why the cost method is superior to capitalizing future earnings, see pp. 18-19 of this paper.

[9]There are some minor differences between the definitions used by the Department of Citizenship and Immigration and those of the Census. For a comprehensive discussion of these differences and their effect upon the immigration figures see Canada, Department of Citizenship and Immigration, Economic and Social Research Division, The Basic Census Data on Immigration and Citizenship (Ottawa, 1963). However, for the aggregative totals we are dealing with, the variation in results from the two definitions is negligible.

[10]In recent years, about 46 per cent of all Canadian immigrants from Britain came by air (Department of Citizenship and Immigration, Information Division). There is no reason to think this number is any less for Canadian-born who emigrate to Britain.

[11]It should be evident at this point why the period 1951–1961 has been chosen – so that Census data could be used to supplement the immigration data.

[12]For details of these calculations, see Canada, Department of Citizenship and Immigration, Economic and Social Research Division, The Basic 1961 Census Data on Immigration on Citizenship, pp. 78-79. See also Pierre Camu, E.P. Weeks, and Z.W. Sametz, Economic Geography of Canada (Toronto: Macmillan, 1964), pp. 64 ff.

[13]Figures for returning Canadians are for the years 1951–1960 inclusive, Canada Year Book: 1961, p. 194.

[14]See the discussion on p. 64 of this paper.

[15]Canada, Department of Citizenship and Immigration, The Basic 1961 Census Data on Immigration and Citizenship, pp. 73-84.

[16]Ibid., p. 1.

[17]Canada, Dominion Bureau of Statistics, Canadian Statistical Review, 37 (November, 1962), p. viii.

[18]In 1950 there were 994,000 white Canadian-born in the United States. By 1960, there were only 939,000, a decline of about 55,000. Because of the large percentage of older people in this group, mortality alone would have caused a decrease of nearly 190,000. Since the observed decline was only 55,000, the implication is that there were approximately 135,000 new emigrants of Canadian birth to America during the period. These calculations are admittedly crude. They refer to the dates of the American Census and not those of the Canadian Census. However, it makes little sense to attempt to adjust the figures to the Canadian Census dates because to do so would necessitate accurate knowledge of the number of Canadian-born returning to Canada during the two periods April 1, 1950–May 31, 1951 and April 1, 1960–May 31, 1961. The absence of knowledge of these flows is precisely the reason why we have to resort to the use of American Census data in the first instance.

[19]Canada, Department of Citizenship and Immigration, Economics and Social Research Division, The 1959 Citizenship Applicants from Toronto and Montreal (Ottawa, 1961), pp. 12-18.

[20]Canada, The Basic 1961 Census Data..., pp. 38-39; see also The 1959 Citizenship Applicants from Toronto and Montreal, pp. 29-36, as well as Canada, Dominion Bureau of Statistics, Canadian Statistical Review, 37 (November, 1962), p. vi.

[21]In 1962 the Canadian Department of Citizenship and Immigration inaugurated a "skill digit" system of classifying immigrants which involves nine education-skill categories ranging from university graduates with at least five years of professional experience to persons with less than six years of schooling and no precise skill. See Economic and Social Research Division, The Skill Content of the 1962 Immigration (Ottawa, 1963). This approach should prove valuable in future analyses but unfortunately it was not in use for the years covered by this study.

[22]United States, Department of Labor, Bureau of Employment Security, United States Employment Service. See Chapter 3 of this paper for a detailed discussion of the data in this manual and for comments regarding estimation of mean general education levels from Canadian Census data.

[23]See Appendix to Chapter 2, Table A, for details on the calculation of these institutional costs.

[24]Canada, Dominion Bureau of Statistics, International Trade Division, The Canadian Balance of International Payments: 1960 (Ottawa: Queen's Printer, 1960), p. 66.

[25]Inheritances and personal and institutional remittances have been excluded from the calculations. These are flow items (rather than stock items like the other figures) and should rightly be viewed as interest received or paid for the human capital involved in immigration and emigration. However, it is impossible to identify these flows with the direction of migration. For example, inheritance funds received in Canada could be due to someone who immigrated to Canada being bequeathed an estate from his family in the homeland: this would be a gain to Canada from immigration. Alternatively, the inheritance could be a result of a member of a person's family in Canada emigrating to the United States and leaving an estate to resident Canadians: the net increase in the deceased's belongings since his emigration would be a return to Canada on emigration. Yet, in both these cases, the funds would be shown on the receipts side of the balance of payments. It would be impossible to determine from the type of records presently available whether they should be counted as interest received or interest paid on human capital movements. Personal and institutional remittances present a similar problem. For example, personal remittances from Canada include payments made by immigrants to their families abroad, but also such items as money sent by American military personnel stationed in Canada to their families in United States. There is also an additional difficulty of separating personal items from institutional remittances.

[26]Funds held by students studying in foreign lands are considered as travel expenditures, not as migrants' funds.

[27]See for example, International Monetary Fund, Annual Report on Exchange Restrictions.

[28]Another study where considerable emphasis has been placed on these other costs of raising children is Alfred H. Conrad and John R. Meyer, "The Economics of Slavery in the Ante Bellum South," Journal of Political Economy, 55 (April, 1958), pp. 95-130.

[29]See Canada, Dominion Bureau of Statistics, Prices Division, Urban Family Expenditure: 1959, Table 2, also Social Planning Council of Metropolitan Toronto, Guides for Family Budgeting, 1964, p. 56.

[30]We are not suggesting that Canada should expect to incur a dollar loss from international migration in the future. In fact, for the years since 1961, the terminal date for the current study, gross immigration has been increasing more rapidly than gross emigration to the United States. From 1962 to 1963, for example, gross immigration increased 25 per cent whereas gross emigration to the United States increased by only 18.5 per cent. Moreover, there has been an increasing number of immigrants in the professional and managerial categories. In the period 1951-1955, for example, 9 per cent of the immigrant labour force were in these two occupational groups; by 1961-1963, however, nearly 24 per cent were in these categories. The percentage of professional and managerial people emigrating to the United States over the same period, has been approximately 30 per cent of the labour force. Consequently, if we were able to obtain net migration statistics for these years and estimates were compiled of the educational investment and other costs represented by such movements, we would probably find emigration to be not as great a percentage of immigration – even in dollar values – as in the current study.

⋆ 3 ⋆

Requisite Levels of Education for the Canadian Labour Force

Two methods of determining worker educational levels required by the Canadian economy are examined in this chapter. The first involves the adaptation of a method recently developed in the United States for determining how much and what type of education and training must be provided to members of the labour force.[1] The second contains an analysis of educational levels that employers' wish prospective employees to have and also examines some of the factors that may affect the level of education demanded by employers.

Both studies are exploratory. Consequently, emphasis is not placed exclusively upon the particular results obtained, but also upon the fruitfulness of pursuing further research along these lines, the modifications in the approaches that will be necessary, and the directions for additional research to which these studies point.

Estimated Education and Training Needs of the Canadian Labour Force

The Method

The two sources of data employed were Estimates of Worker Trait Requirements for 4,000 Jobs, prepared by the United States Department of Labor,[2] and the 1961 Canadian Census. The technique was to use the former source to estimate education and training times for the occupational[3] groups and total labour force as shown in the Canadian Census data. These estimates were then compared to prevailing educational levels in the occupational categories and entire work force, and similarities and differences were noted.

A few comments regarding the nature of the data used and the method involved are now in order. Each of the 4,000 occupations included in the first source are graded according to the training time needed by workers to develop the knowledge and abilities "necessary for average performance in a particular job-worker situation".[4] This training is divided into two types: general education development (GED) and specific vocational preparation (SVP).

General education development relates to those aspects of education by which workers develop their reasoning powers and their abilities to follow instructions and adjust to the work environment. It also includes the acquisition of mathematical and language skills. Seven levels of development (described in detail in Table 12) are thus distinguished according to the degrees of reasoning, mathematical and language attainment involved.

The amount of time required by workers to develop the facility necessary for average performance on the job is referred to as specific vocational preparation. It encompasses on-the-job training, formal instruction by employers, apprentice training, and vocational education in the formal school system. The nine levels of this classification are indicated in Table 13.

Strictly speaking, GED and SVP cannot easily be separated, for, as mentioned in the chapter on immigration and emigration, one acquires some vocational preparation in regular general education programs; and vocational training programs contribute to one's reasoning, mathematical, and language skills. To some extent, then, there is an overlap of the two classifications. This should be borne in mind throughout the subsequent analysis.

The procedure followed in estimating required education and training times was straightforward. Using the Occupational Classification Manual: Census of Canada, 1961, the 273 occupational groups in the Census were analyzed to determine the individual occupations included in each group. The GED and SVP levels for as many as possible of these occupations were then obtained from Estimates of Worker Trait Requirements for 4,000 Jobs. Where GED and SVP levels differed for the individual jobs in an occupational group, averages of all jobs were taken. To illustrate with respect to GED levels, measures such as 4.5 or 5.5 years of schooling were employed. These provided more specificity than would otherwise have been possible. In nearly all cases, it was necessary to assume that the requirements of particular occupations were the same in every industry. The exceptions were "owners and managers not elsewhere specified" (where eleven different

TABLE 12
SCALE OF GENERAL EDUCATION DEVELOPMENT

Level	Reasoning Development	Mathematical Development	Language Development
7	Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with nonverbal symbolism (formulas, scientific equations, graphs, musical notes, etc.) in its most difficult phases. Deal with a variety of abstract and concrete variables. Apprehend the most abstruse classes of concepts.	Work with a wide variety of theoretical mathematical concepts and make original applications of mathematical procedures, as in empirical and differential equations.	Comprehension and expression of precise or highly connotative meanings, as in: - Journal of Educational Sociology. - Scientific Monthly. - Works in logic and philosophy, such as Kant, Whitehead, Korzybski. - Literary works, such as Stein, Eliot, Auden.
6	Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions, in books, manuals, mathematical or diagrammatic form. Deal with several abstract and concrete variables.	Make standard applications of advanced mathematics, as differential and integral calculus.	Comprehension and expression as of: - Saturday Review of Literature, Harper's. - Scientific American. - Invitation to Learning (radio program).
5	Apply principles of rational systems* to solve practical problems. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form. Deal with a variety of concrete variables.	Perform ordinary arithmetic, algebraic, and geometric procedures in standard, practical applications.	Comprehension and expression as of: - Popular Science. - America's Town Meeting of the Air (radio program).
4	Apply common sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables.	Making arithmetic calculations involving fractions, decimals and percentages.	Comprehension and expression as of: - Readers' Digest. - American Magazine. - Lowell Thomas (radio program).
3	Apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables.	Use arithmetic to add, subtract, multiply, and divide whole numbers.	Comprehension and expression as of: - "Pulp" detective magazines. - Movie magazines. - Dorothy Dix. - Radio "soap operas".
2	Apply common sense understanding to carry out spoken or written one- or two-step instructions. Deal with standardized situations with only one or two, or very occasional, variables entering.	Perform simple adding and subtracting.	Comprehension and expression of a level to: - Sign name and understand what is being signed. - Read simple materials, such as lists, addresses and safety warnings. - Keep very simple production records.
1	Apply common sense understanding to carry out very simple instructions given orally or by demonstration. No variables.	None - - - - - - - - - - - - - -	No speaking, reading, or writing required.

* Examples of "principles of rational systems" are: bookkeeping, internal combustion engines, electric wiring systems, house building, nursing, farm management, ship sailing.

TABLE 13
SPECIFIC VOCATIONAL PREPARATION
CLASSIFICATION

Level	Training Time
1	Short demonstration only.
2	Beyond short demonstration - 30 days.
3	Over 30 days - 3 months.
4	Over 3 months - 6 months.
5	Over 6 months - 1 year.
6	Over 1 year - 2 years.
7	Over 2 years - 4 years.
8	Over 4 years - 10 years.
9	Over 10 years.

owner-managerial categories were distinguished) and "labourers n.e.s." (where six separate categories were used). This made a total of 288 occupational groups included in the analysis.

The nine specific vocational preparation periods were designated by their mid-points in terms of years. General educational development was also expressed in terms of equivalent years of schooling, using estimates provided by two separate sources.[5] The years of schooling or training employed for each were as shown in Table 14. The gaps in years between different levels are considerable, especially at the higher levels. However, by employing the mid-points between GED and SVP levels, as indicated, the errors that would naturally result from these wide divisions were minimized as much as possible.

Estimates were then made of the years' of schooling required by persons to achieve the general education development and vocational skill necessary in each of the 288 occupational groups. Estimates were also made of the average of these requirements for the 51 major sub-divisions used, for the 12 main divisions of occupations, for males and females separately, and both sexes together, the weights in every case being proportional to the number of persons in the categories concerned.

TABLE 14
AVERAGE GED AND SVP TRAINING TIMES

GED	Equivalent Years of Schooling	SVP	Average Training Time in Years
1	0.0	1	.00
2	5.0	2	.04
3	7.0	3	.17
4	9.0	4	.38
5	12.0	5	.75
6	16.0	6	1.50
7	19.0	7	3.00
		8	7.00
		9	12.00

Mean actual educational levels for the various occupational divisions, subdivisions and groups were next computed, so that existing educational attainments of the labour force could be compared with the amounts required according to worker-trait-requirement estimates. The seven educational ranges provided for each occupational category in the Census data, the means used to represent each range and some of the difficulties associated with using means are indicated in Table 15.

Before examining the results, a number of questions connected with the use of the GED and SVP estimates should be mentioned.

Some Reservations

The overlap that occurs between GED and SVP levels has already been noted. Another difficulty is that the manual dealing with worker-trait-requirements was developed to assist employment officers in the placement of applicants in jobs best suited to them. It was not anticipated that the GED levels would be equated to specific years of schooling. One problem that arises when this is attempted is that the levels of mathematical and language development specified for any one GED level may not necessarily both be

TABLE 15
YEARS OF SCHOOLING IN CENSUS DATA[1]

Census Category	Mean Years Used
Less than 5 years	2.5[1]
5 to 8 years inclusive	6.5[1]
9 and 10 years	9.5
11 years	11.0
12 and 13 years (high school)	12.5
Some university	14.5
University degree	16.3[2]

Source: 1961 Census of Canada: Vol. 3, Part I: Labour Force, Occupations by Sex, Showing Age, Marital Status and Schooling. (Ottawa: Queen's Printer)

Notes: [1] In these two categories, particularly, one might think the use of means instead of medians would result in our figures for educational levels being lower than those which actually exist. For example, it could be argued that in grades 5 to 8, since grade 8 is the usual grade which students are required to achieve before quitting school (unless they first reach age 14-16, depending upon the province and circumstances), something above the mean of 6.5 should be used; e.g., 7 or even 7.5 years. However, studies recently completed at the Dominion Bureau of Statistics indicate that average years of schooling of the current labour force based upon calculation of medians are almost the same as results using means. In some cases the means were higher instead of lower than the medians. Consequently, it does not appear that the use of means will have underestimated educational levels.

[2] About one-half the provinces still grant university degrees, at least in Arts and Sciences, requiring three years study after grade 12, thus implying that 15 years should be employed as an estimate of total years education for one degree. On the other hand, many first degrees are four years, and in a number of provinces, this is four years after Grade 13 in high school. In these cases, 17 years would be a more appropriate figure. Thus, the mean of 16 years was chosen to represent years required for a single degree. An examination of the degrees granted over 12 selected years between 1920-1921 and 1960-1961 indicated that an additional 0.3 year should be added to this estimate to account for the proportion of degrees at the masters' and doctorate level; Canada, Dominion Bureau of Statistics, Education Division, Survey of Higher Education: 1954-1961, Table 9. The total estimate of 16.3 years may still underestimate the average years education of those with university training because no additional allowance was made for those who achieved two degrees at the bachelor level -- for example, a B.A. and LL.B., or B.A. and B.D.

achieved at the identical school grade. For example, the mathematical achievement specified by GED level 4 may be attained in Grade 8, whereas the language development for this level may not be reached until Grade 10; similar problems arise with the other levels. Consequently, the years of schooling chosen to represent any one GED level must necessarily be a compromise. With respect to university training, an additional difficulty is that students may choose courses which do not require both language and mathematical development, so a person might be adept in one area and quite deficient in the other. In such instances, the general reasoning development along with one or the other of the language and mathematical skills required by the GED level has been employed as a guide to the years of schooling involved.

It should also be noted that the GED and SVP estimates were prepared for use among the United States labour force, as was the Dictionary of Occupational Titles itself, so the above training-time estimates may not be applicable to Canada. In one respect, however, these difficulties may not be as serious as might at first be thought: the Dictionary of Occupational Titles is, in fact, used throughout the country by the National Employment Service and has been found to be quite satisfactory. Moreover, the fact that GED levels are stipulated in terms of reasoning, mathematical, and language ability rather than years of schooling is actually an advantage, in that differences between American and Canadian standards of schooling do not affect these estimates. Instead, one is free to assign to these GED levels the number of years education applicable to Canada.

A more difficult problem, however, is the possibility that the suggested general education and vocational preparation levels are influenced by what American job analysts observe to be the standards of development and training possessed by the workers in the various jobs. To this extent, biases may exist in their estimates. Since the average education of United States labour force participants is higher than that of their Canadian counterparts, one might expect there would be a tendency to overestimate the reasoning, language, and mathematical development required of workers in particular occupations in comparison to Canadian needs. Nevertheless, as will be seen in a later section of this chapter, there seems to be no consistent bias one way or the other for the labour force as a whole. Rather, there tends to be an overestimation of general educational needs in some occupational groups and an under-estimation in others. However, more will be said about the accuracy of these GED ratings in relation to individual jobs after the analysis of employers' requests for the job applicants is completed later in this chapter.

Since GED and SVP estimates will be compared to 1961 Canadian Census data, one or two items should be remembered with respect to the census material. In the 1961 Census survey, people were asked what was the highest level of schooling they had experienced, not the highest one for which they had obtained a certificate. This fact, combined with the tendency of people to inflate their educational achievements in response to census inquiries, may mean that the census figures indicate a higher level of education than was, in fact, possessed by the labour force in that year. On the other hand, many people acquire general education after they leave school, not only through night and correspondence courses, but also through everyday reading. Such education will not be recorded in the Census data. There is no way of knowing to what extent these divergent tendencies offset one another, but they should both be kept in mind when interpreting the results discussed here.

Finally, it should be understood that, in comparing estimated educational requirements of workers with recent census data, it is not intended to imply that the present occupational mix is the ideal one. All that is being shown is actual educational levels in relation to requirements estimated by the present approach. The results and their implications will now be examined.

Observations

Table 16 summarizes those percentages of people in the labour force who possess different amounts of general education and the percentages that are estimated to require these amounts of education according to this study. Certain relatively strong and weak points in the Canadian education hierarchy are revealed in the table.

Even allowing for a margin of error in the GED estimates, it is apparent that a shortage exists in the numbers of both sexes with a university degree. To some extent this shortage is exaggerated because in all occupations where members were shown in the census data as possessing a university degree, 16.3 years was used (for consistency) as the length of schooling involved. However, in the case of physicians and surgeons, this figure is clearly an underestimate; 19 or 20 years would be more accurate. Similarly for lawyers, dentists, or ministers who have a B.A. as well as their professional degree, the estimate of 16.3 years is too low. While the method used therefore will account in part for this discrepancy between the percentage of workers who require university training and the number who actually have it, the difference is too great to be wholly explained in this manner. It must be concluded

TABLE 16
PERCENTAGES[1] OF LABOUR FORCE WITH VARIOUS LEVELS OF EDUCATION: ACTUAL AND REQUIRED

Level of Education		Actual	Required
		(1961)	(GED Level)
		(per cent)	
1. At least one university degree:	Male	4.8	12.2
	Female	2.7	10.7
	Both Sexes	4.3	11.8
2. Full High School or some University[2].	Male	19.6	31.6
	Female	31.4	12.4
	Both Sexes	22.8	26.3
3. Grades 9, 10 or 11:	Male	31.1	32.5
	Female	36.0	49.2
	Both Sexes	32.5	37.0
4. Up to Grade 8:	Male	44.5	23.8
	Female	29.9	27.7
	Both Sexes	40.4	24.8
Full High School or More: (items 1 and 2 expressed as a total)	Male	24.4	43.8
	Female	34.1	23.1
	Both Sexes	27.1	38.1

Notes: [1] Percentages may not add to 100.0 due to rounding.

[2] The total number of occupations where some university but not a full degree is required from a very small proportion of this group -- less than one per cent.

that, from this viewpoint of technological requirements of occupations there appears to be a genuine deficiency of university trained personnel.

It is also worth noting that the total number of persons requiring university education is still only 11.8 per cent of the labour force.[6] Although this figure may rise as technological change necessitates a higher proportion of university people in the work force,[7] it nevertheless provides a rough guide as to the present needs of the economy for this type of worker.

Also to be noted is the apparent deficiency of men with a full high school education: 31.6 per cent of the male labour force should have such schooling according to this approach whereas only 19.6 per cent actually possess it.[8] Part of this deficiency may be due to the GED estimates for some male occupations (particularly of a skilled nature) being too high - at least compared with what will later be seen are employers' standards. But, as will also be pointed out, there are instances where the GED estimates seem low, so that, on the whole, such differences tend to cancel one another out.

With respect to female workers, the actual percentage with a full high school education (31.4 per cent) greatly exceeds the proportion (12.4 per cent) which require it according to the GED figures. Once again, as will subsequently be noted, instances of apparently high GED estimates tend to be offset by other instances where they are on the low side. Consequently, this apparent abundance of high-school-educated women workers cannot be attributed entirely to inaccuracies in the GED method. Furthermore, in the particular occupations that were examined in some detail, differences between GED estimates and employers' requirements were differences between, for example, Grade 9 in the former and Grade 10 or 11 in the latter. Thus, even here, if the GED figures had been up to the level of employers' requests, the apparent surplus of women with Grade 12 education would not be removed. Moreover, if the deficiency in the number of university-trained women was eliminated through a proportion of this high-school-diploma group taking additional schooling, there would still be a strong reserve of female labour force participants with sufficient education to perform work demanding more of them than their current occupations.

This reserve of educated women, combined with the lower educational qualifications of many male workers, could be partly responsible for the continual displacement of men by women in occupations such as clerical and sales jobs - once thought to be

the exclusive domain of men. Clarence Long[9] suggests that the great rise in the schooling level of the average female both in absolute terms and relative to that of older males is one of the three dynamic forces that explain the increasing female participation rate and the stable participation of the total population of working age over both short- and long-run periods of fairly high employment. He goes on to state that:

> In conjunction with the growing need for clerical and service labour, this [the higher educational level of women] probably gave women a comparative advantage over the less well-trained and frequently overpaid older worker and the untrained child; and it may account for ability of the market to absorb the increased supply of women.
>
> The increase of female workers may in turn have forced the exodus of the young and older males. Women - better trained and better suited for the jobs, and often willing to work for less - may well have out-competed males in the job market and made employers ready to pass rules against older workers (which to so many have appeared to be the real force in compelling earlier retirement).[10]

In any case, whether this conjecture is correct or not, the abundance of well-educated women and the apparent shortage of men with adequate schooling suggest that one or both of two policy measures should be stressed. The first is that greater use should be made of the educated women in our labour force. The second is that much more emphasis might well be placed upon methods of upgrading existing male workers and by providing sufficient incentives to young men to remain in school longer.

When general education and specific vocational preparation time for each major occupational division and the entire labour force are examined (Table 17), a number of other interesting features emerge:

1. Among the occupational divisions, there are five groups (comprising 55 per cent of the labour force) in which the 1961 levels of education are close to or more than two years below the suggested GED levels. These groups are managers, farmers, professionals, craftsmen, and miners. While the need for additional education among professional people is generally recognized,

TABLE 17
ACTUAL AVERAGE EDUCATION, CANADIAN LABOUR FORCE, 1961 CENSUS, AND ESTIMATED GENERAL EDUCATION[1] AND SPECIFIC VOCATION TRAINING REQUIRED

	Labour Force 1961	1961 Census Average Education (Years)	Years of Education by GED Level (Years)	Difference (Years)	SVP (Years)
1 Owners and Managers:					
Males	481,379	10.5	14.8	-4.3	5.14
Females	57,661	9.8	13.3	-3.5	3.99
Total	549,040	10.4	14.7	-4.3	5.01
2 Professional and Technical Occupations:					
Males	356,578	13.8	15.9	-2.1	3.98
Females	272,333	12.7	14.5	-1.8	2.92
Total	628,911	13.3	15.3	-2.0	3.52
3 Clerical Occupations:					
Males	324,811	10.4	10.0	.4	.57
Females	509,345	11.0	9.8	1.2	.62
Total	834,156	10.8	9.8	1.0	.60
4 Sales Occupations:					
Males	263,229	10.3	10.4	-.1	.61
Females	147,486	9.5	9.1	.4	.22
Total	410,715	10.0	9.9	.1	.47
5 Services and Recreation Occupations:					
Males	400,399	8.7	8.7	.0	.60
Females	395,948	8.1	8.1	.0	.41
Total	796,347	8.4	8.4	.0	.50

TABLE 17 (Continued)

	Labour Force 1961	1961 Census Average Education (Years)	Years of Education by GED Level (Years)	Difference (Years)	SVP (Years)
6 Transportation and Communication Occupations:					
Males	354,736	8.2	9.3	-1.1	.46
Females	37,968	10.0	9.0	1.0	.20
Total	392,704	8.4	9.2	-.8	.43
7 Farmers and Farm Workers:					
Males	573,098	7.2	10.3	-3.1	2.11
Females	75,868	7.3	7.6	-.3	.51
Total	648,966	7.2	10.0	-2.8	1.92
8 Loggers and Related Workers:					
Males	78,826	6.4	7.6	-1.2	.37
Females	117	6.8	7.6	-.8	.19
Total	78,943	6.4	7.6	-1.2	.37
9 Fishermen, Trappers and Hunters:					
Males	35,648	5.9	7.0	-1.1	.19
Females	274	6.5	7.0	-.5	.19
Total	35,922	5.9	7.0	-1.1	.19
10 Miners, Quarrymen and Related Workers:					
Males	65,119	7.6	9.4	-1.8	2.43
Females	20	8.3	5.0	3.3	.03
Total	65,139	7.6	9.4	-1.8	2.43

TABLE 17 (Concluded)

	Labour Force 1961	1961 Census Average Education (Years)	Years of Education by GED Level (Years)	Difference (Years)	SVP (Years)
11 Craftsmen, Production Process and Related Workers:					
Males	1,354,594	8.2	10.1	-1.9	1.95
Females	205,189	7.6	8.3	-.7	.97
Total	1,559,783	8.1	9.9	-1.8	1.82
12 Labourers n.e.s.:					
Males	294,059	7.2	6.1	1.1	.04
Females	20,943	7.6	6.8	.8	.04
Total	315,002	7.2	6.2	1.0	.04
13 Occupations not stated:					
Males	123,042	9.2	-		-
Females	43,178	9.8	-		-
Total	166,220	9.3	-		-
ALL OCCUPATIONS:					
Males	4,705,518	9.0	10.3	-1.3	1.85
Females	1,766,332	9.8	9.6	.2	1.01
Total	6,471,850	9.2[1]	10.1	-.9	1.60

Notes: [1] The average education level shown here is lower than the average shown for the entire population of Canada in 1951 by such publications as DBS A Graphic Presentation of Canadian Education (Ottawa: Queen's Printer, 1961), p. 13. The possible reasons are twofold:

(a) The use of 16.3 years for those with a university education may be on the low side.

(b) The figures refer to labour force participants only, whereas there are young people in the 14-19 age cohort with more than this average amount of education who are still in school and university.

It should be noted, however, that use of means rather than medians in these calculations cannot be considered a reason for any underestimates of the education level which may exist. Recent analysis at the Dominion Bureau of Statistics indicate little or no difference occurs in average educational levels of the work force when means are used instead of medians.

the weakness in the qualifications of farmers frequently tends to be overlooked, particularly since the agricultural group, both absolutely and as a percentage of the labour force, has been declining steadily over the past 30 years. (See Table 18.) That farmers should possess Grade 10, as the GED estimates suggest, does not seem unreasonable if one bears in mind the influences of the technological change in farming in recent years and the current increased emphasis upon reports and record keeping.

2. The GED estimates for clerical, sales, service and recreation, and labouring occupations (accounting for 37 per cent of the labour force) indicate that the actual education levels were equal to or greater than the levels necessary for average job performance. Table 18 shows that apart from the professional occupations, the clerical, sales (commercial) and service occupations (together equalling about one-third of the labour force) were also the fastest-growing groups in the economy between 1951 and 1961. These two pieces of evidence together suggest that much of the recent emphasis upon everyone requiring additional general education, because those occupations growing most rapidly are also the occupations that call for much higher educational levels than those presently existing is misleading. The emphasis is justified for the professional occupations but not, apparently, for the others. Even if the GED levels were a full year too low for all clerical personnel - and, as will be seen later this does not appear to be the case - the estimated educational level required for these groups would still not be greater than the average level of 9.9 years actually existing. Moreover, due to causes indicated earlier,[11] the actual average educational level may be underestimated, so that for this reason too, current levels of general education in these occupational groups appear adequate relative to the GED requirements.

3. The average educational level for all labour force members in 1961 of 9.2 years is nearly one full year below the required level of 10.1 years derived from the GED estimates. Observations indicate that this deficiency is concentrated in certain fields of work. Therefore, since the resources to be devoted to education are not unlimited, it would seem prudent to concentrate on these areas first, and not necessarily attempt to raise educational standards for all people at once.

4. The estimated average amount of specific vocational preparation required by labour force participants is 1.6 years. The highest training time is associated with those five occupational divisions where actual educational levels were below GED estimates.[12] While no detailed information is available on the actual

TABLE 18
DISTRIBUTION OF THE LABOUR FORCE
BY OCCUPATIONAL DIVISIONS, 1961
AND PERCENTAGE INCREASES, 1931-1961

	Percentage of Total Labour Force 1961	Percentage Increases	
		1931-1961	1951-1961
All Occupations	100.0	61.7	21.6
White Collar	38.6	155.4	44.7
Managerial	7.9	128.0	27.5
Professional	10.0	166.4	64.5
Clerical	12.9	214.2	45.4
Commercial and financial	7.8	105.5	41.2
Manual	34.9	67.2	12.7
Manufacturing and mechanical	16.4	129.2	14.2
Construction	5.3	83.0	15.3
Labourers	5.4	-22.2	-2.1
Transportation and communication	7.8	102.1	20.2
Service	10.8	88.0	53.2
Personal	9.3	81.6	54.0
Protective and other	1.5	140.1	49.6
Primary	13.1	-34.9	-20.9
Agricultural	10.2	-42.5	-21.9
Fishing and trapping	.6	-22.5	-30.2
Logging	1.3	89.2	-21.4
Mining and quarrying	1.0	12.7	-1.0
Not Stated	2.6	-	

Source: Canada, Department of Labour, Economics and Research Branch, Occupational Trends in Canada 1931 to 1961 (Ottawa: Queen's Printer, 1963), Table 4.

amount of training possessed by labour force participants, the data provided here do suggest the relative amounts of training required by members of each occupational group, and indicates that on the average, 11.7 years of general education and specific training together are necessary for labour force participants. Since there is some overlap between the two forms of education, the true average would be less than this figure.

The above remarks indicate that this approach not only provides estimates of the levels of education and training required in each of the major occupational groups but, by comparing these figures with the recent census data, it is possible to determine the areas that require immediate attention. Clearly, the professional and managerial groups presently have the greatest educational deficiencies. This suggests that not only should there be concern with providing university training to young people intending to enter these occupational groups, but current labour force participants in these areas should also be receiving additional training. In most cases, this would involve considerable updating of their existing skills and knowledge. Concentration upon more training for workers who are currently employed may be one of the most important segments of an educational program. Gordon Brown, Dean of Engineering at the Massachusetts Institute of Technology, recently emphasized this point with respect to engineers:

> In the international debate about the shortage of people trained to advanced levels in modern technology, have we not overlooked the engineer already in practice? If the knowledge and skill of selected, key, practicing engineers were updated and reoriented, these men could help greatly to close the gap. As the pace of scientific advance continues, the knowledge of engineers who have been out of school for a number of years lags more and more. It appears that the quickest, and perhaps the best, way to fill the gap, in both numbers and capability, in industry and education, is to embark on a formal programme of updating and reorienting the skills of the most promising men now in these two fields.[13]

It should also be noted that, for the remaining major occupational divisions, although several of them do call for people to obtain additional general education beyond what they presently possess, university training - or even full high school - does not, on the average, appear necessary in order to satisfy the requirements of the economy. This is especially applicable to

women workers: the kinds of work typically performed by women in this context do not appear to warrant general education beyond the level that most of them ordinarily tend to reach at present - although it is certainly quite possible that many of them do require additional vocational training.

Future Research Needs

The current estimates should only be considered as a beginning. As will be seen shortly, the method does not appear to provide figures sufficiently accurate to determine educational requirements for individual occupations. Such detailed information will only be obtainable by using more precise methods. One possibility is discussed in the next section of this paper.

Additional research will also be required to determine the proportion of persons who must commence training for any one occupation or occupational group in order to allow for drop-outs and movements among jobs. People may drop out from either lack of ability or motivation. Shifts among jobs may occur as a result of changes of interest or because, as peoples' knowledge of opportunities increases, the monetary or even non-monetary characteristics of another profession or vocation attracts them. As governments assume a greater responsibility for more complete dissemination of information on the nature and characteristics of occupations within the economy, the allowances necessary in any manpower-planning program for losses due to school drop-outs or shifting between jobs may be lowered. But much remains to be done in this area.

Research is also needed to discover the kind of basic education workers should have so that they are later able to change jobs or absorb retraining in the event that technological change eliminates their current occupations. Although the popular view is that more education should be given to everyone while they are young and still in school, there is, as yet, no conclusive evidence that this is the best course to follow. It may be more efficient and effective to provide the additional schooling later in life when the need for it arises, and when the most up-to-date knowledge can be offered.

The above approach does not attempt to estimate educational needs for cultural or citizenship purposes; undoubtedly, these will have to be determined on other than purely economic grounds. There are also one or two other observations to be made regarding this technique, but these must be preceded by a discussion (in the following section) of another approach to determining educational requirements of the labour force.

Employers' Educational Requirements

This section contains an examination of the potential worth of using employers' orders for new employees as a means of determining the educational requirements of occupations. At the outset, it analyses some of the factors affecting employers' educational requirements. Discussion of this matter is enlarged upon to consider (1) whether employers' requests might be relied upon as representing the actual educational needs of the occupations involved, or (2) whether their educational specifications are used primarily as a screening device that may be modified according to the availability of educated people and not according to the requirements of the job. Next, employers' educational specifications are compared with the estimates of educational needs developed from Estimates of Worker Trait Requirements for 4,000 Jobs and with the prevailing levels of education for the same occupations according to the 1961 Canadian Census. Some conclusions are then set out concerning the relative merits of the two methods of determining occupational requirements examined in this chapter.

The Survey Procedure

When employers report job openings to the National Employment Service, special order cards are prepared showing such details as education and experience demanded, and wages or salary to be paid. Other information - either indicated on the cards or available at the local employment offices - includes the size of the potential employer (in terms of the number of employees), his industry, and the province and size of city in which he is situated.[14]

Normally, order cards are retained by employment offices for one year after they are either filled or cancelled. In the current survey, all inactive cards for the month of November 1962, covering a sample of occupations, were collected from the more than 200 offices across Canada. There are over 9,000 occupations listed in the United States Dictionary of Occupational Titles (which is also used in Canada). In any one month about 125,000 requests for employees are made through the National Employment Service. An attempt was therefore made to select a sample of occupations so that a sufficient number of cards for each occupation would be received to permit analysis. It was also necessary to try to ensure that the occupations chosen would have a sufficiently narrow range of duties so that differences observed in the educational requirements of employers would not merely reflect these differences in duties and nothing more. At the same time, jobs specifically

mentioned in Estimates of Worker Trait Requirements for 4,000 Jobs were needed so that estimates of the educational levels obtained from both sources could be compared.

With these specifications in mind a final list of 85 occupations was compiled.[15] The number of jobs chosen in each major occupational group are shown in Table 19.[16]

TABLE 19
OCCUPATIONAL GROUPS SELECTED IN EMPLOYER ORDER CARD SURVEY

Major Occupational Group	Number of Occupations Chosen
Professional	11
Semi-professional	13
Managerial and official	9
Clerical	21
Sales	7
Service	3
Skilled workers	7
Semi-skilled workers	9
Unskilled workers	5
	85

The majority of the occupations fall in the first four categories. This was necessary because there were few occupations in the last five divisions for which educational requirements were normally specified by employers. However, it was decided to include several jobs from each of these groups in the hope of obtaining some idea of the current educational requirements in these jobs.

Analysis of Factors Affecting Employers' Educational Requirements

A total of 7,805 employers' orders were received. After eliminating all cards in which educational requirements[17] and/or wage-salary data were not specified, as well as those occupational

groups with too few observations to be analyzed separately and which could not reasonably be grouped with other occupations, there remained 37 occupations involving 2,182 observations.

As the following list of those jobs with greater than 50 data cards indicates, the majority of the observations were concentrated in relatively few occupations.

TABLE 20
OCCUPATIONS WITH MORE THAN
FIFTY OBSERVATIONS

Occupation	Number of Observations
Junior executive	57
Accounting clerk	61
Clerk: general office	450
Stenographer	290
Typist	145
Stock clerk	136
Labourer: stores	260
	1,399

The information coded from the raw data cards and key-punched on IBM cards was as follows:

(i) occupation number (corresponding to individual numbers in the Dictionary of Occupational Titles);

(ii) years of education wanted by employer;

(iii) province;

(iv) employer size (in terms of the number of employees);

(v) size of urban centre;

(vi) industry;

(vii) whether employer wanted an experienced person;

(viii) hourly wages offered.

It would have been desirable to have included the age of employees requested by employers as an additional factor whose influence upon, or relationship to, educational requirements might have been examined. However, there were insufficient cards with age preference shown to warrant its inclusion. Similarly, information as to whether or not formal training was to be offered by employers might also have been introduced; but, again, not enough cards gave this information. The sex of desired employees could also have been included but it was evident that some jobs were primarily for males and others primarily for females; therefore this additional variable would have contributed little to the analysis.

Of the data itemized above, the last six items were taken as independent variables. The first purpose of the investigation was to determine the nature of the effects, if any, which these factors - either singly or in combination - had upon the level of education that employers requested when they hired employees for particular positions. The ideal method, therefore, would have been an analysis of variance, whereby both the sources of variation and the degree of variation attributable to each source could be distinguished. The difficulty with this approach, however, was that even if wages had been excluded and the remaining five independent variables had been coded so that each of them could take on only two values, there still would have been 2^5 or 32 separate possibilities or cells which could occur for any one occupation. Because, as already indicated, few jobs had more than 50 observations, there was little chance that all of the cells for any single job would contain information - especially since many of the observations were frequently concentrated in only a few of the cells. Even when only four of the independent variables were employed so that there were 2^4 or 16 possible cells into which the observations on any one occupation could be classified, only four jobs had observations appearing in every cell. Even for these jobs, many cells contained only one observation. Thus, it was evident that some approach other than analysis of variance would have to be employed. The chosen alternative was multiple regression analysis involving the use of dummy variables to represent the qualitative variables in the data.[18]

The following multiple regression equation was therefore set up to test the relationship between the educational levels requested by employers and the variables indicated above:

1. X_1: the educational level of the region in which the employer is situated. $X_1 = 0$ for eastern Canada and $= 1$ for western Canada. If employers use educational requirements as a

selection device, raising or lowering them according to the level of schooling prevailing in the area, then one would expect to find more education required by employers in the western provinces (Ontario to the Pacific) where the average education level of the work force in 1961 was nearly a full year higher than in the east (Quebec and the Maritimes) - 9.6 years compared to 8.8.[19]

2. X_2: the size of urban centre concerned. $X_2 = 0$ for urban centres less than 100,000 and = 1 for urban centres of 100,000 or more. Since residents of the larger centres (those with populations of 100,000 or over) have higher educational levels than do those of the smaller cities,[20] it might again be expected that if employers are stipulating their educational requirements according to the level of education possessed by workers then, for any particular occupations, higher schooling would be wanted by employers in the larger centres. This factor may be reinforced by the presence of colleges and universities in all of the larger centres, while such is far from the case in the smaller urban locales. Furthermore, while only 43.4 per cent of Canada's population lives in centres of 100,000 or more, 50 per cent of the students were from such centres.[21]

3. X_6: wages offered in their quantitative form. This represents the assumption that wages offered reflect employers' estimates of workers' marginal productivities,[22] and that better-educated people are more productive; then, where higher wages are quoted, higher educational requirements are to be expected. If, however, employers are requesting additional education in job applicants solely because better-educated people are available, then one would not expect wages offered to have any significant or consistent relationship with the educational level requested.

Each of these three variables bears upon the same question: whether employers are setting their educational requirements for prospective employees according to what they deem is necessary for satisfactory job performance, or whether they are asking for additional education among new employees simply because better-educated people are available in certain areas. The three following variables also relate to businessmen's educational specifications, although they do not in themselves provide as clear-cut information on whether employers are asking for more education simply because it is available.

4. X_3: size of employer (measured in terms of the number of employees). $X_3 = 0$ for employers with less than 75 employees and = 1 for employers with 75 or more employees. Larger employers are likely to set higher educational standards for purposes

of promotion and greater flexibility in the selective usage of employees. Increasing complexity of larger establishments may also be a factor producing the same type of effect.

5. X_4: whether experienced job applicants are desired. If experience is deemed a substitute for education by employers, there would be a negative relationship between the two. Although it would have been desirable to specify the amount of experience requested, only two categories could be distinguished: $X_4 = 0$ where experience was not required and = 1 where experience was required.

6. X_5: industry group. $X_5 = 0$ for primary, secondary, transportation or public utilities and = 1 for trade, finance, or service. There are two conflicting possibilities here: on the one hand, those industries (trade, finance and service) whose major type of employee is a member of those occupations growing the most rapidly (clerical, commercial, and service)[23] may tend to demand higher educational achievement among job applicants for purposes of internal promotion as expansion continues. On the other hand, it could be asserted that because these industries seek the largest number of such employees, they will have to take a proportionately larger number of those with lower education. One's first feeling, therefore, is to doubt that any consistent relationship will be evident between industries and educational levels required in particular occupations. If there is no such relationship, it may also indicate that the general educational requirements for the individual occupations are similar among industries.

In summary form, the multiple regression equation was $Y = a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6$, where Y = education level, and X_1, X_2, X_3, X_4, and X_5 are dummy variables as follows:

Variable		Value	Interpretation
X_1	=	0	where province was Newfoundland, one of the Maritime provinces, or Quebec.
	=	1	where province was Ontario, or one further west.
X_2	=	0	where urban centre had less than 100,000 people.
	=	1	where urban centre had 100,000 or more people.

LEVELS OF EDUCATION

Variable		Value	Interpretation
X_3	=	0	where the employer had less than 75 employees.
	=	1	where the employer had 75 or more employees.
X_4	=	0	where employers did not ask for experienced personnel.
	=	1	where experienced personnel were requested.
X_5	=	0	where industry was primary, secondary, transportation or public utilities.
	=	1	where industry was trade, finance, or service.
X_6	=		wages, used in quantitative form.

With respect to the use of dummy variables for each of the independent variables (with the exception of wages) it should be mentioned that the multiple regression equation as specified does not allow for interaction effects among the dummy variables. To have done so would have necessitated the introduction of additional dummy variables, one for each interaction effect: e.g., $K_1 = X_1X_2$, $K_2 = X_1X_3$, and so on. But this would have created the identical problem which necessitated rejection of analysis of variance - a number of cells with few or even zero observations in them.

Regarding the interpretation of the equation, since the dummy variables may take on only the values of 0 and 1, it implies that when one of these variables equals 1, there is a shift upward in the education level required equal to the coefficient of the variable.

Multiple regressions were run on 37 occupations. Results on seven of these runs were excluded because one or more of the dummy variables turned out to be constant in spite of the broad categories employed above for these variables. Of the remaining occupations, only in 10 cases (as indicated in Table 21) were the coefficients of multiple correlation significant at either the 5 per cent or 1 per cent level. For these 10, the R^2's, indicating the proportion of the total variance in education which is explained by the above equation, were in few instances over 0.60.

In these occupations, generally less than half of the coefficients of the X's were themselves significant. To determine whether there was any consistency in the direction of the influence of the independent variables upon education over all the occupations, the signs of the coefficients for each variable were tabulated for the 10 occupations where the multiple R's were significant, as well as for all the 30 occupations.

TABLE 21
SIGNIFICANT MULTIPLE CORRELATION
COEFFICIENTS ON OCCUPATIONS

Occupation	Multiple Correlation Coefficient (R)	R^2	Level of Significance (per cent)
Chemist assistant	0.7368	0.5429	5
Production and personnel managers	0.8612	0.7417	5
Junior executives	0.8329	0.6937	1
Accounting clerk	0.6809	0.4636	1
Cashier I	0.8682	0.7538	5
Clerk, general office	0.3655	0.1336	1
File clerks I and II	0.7750	0.6006	5
Stenographer	0.3278	0.1075	5
Telephone solicitor	0.8016	0.6426	5
Labourer, stores	0.3732	0.1393	1

Source: Appendix 3, Table B, which contains details on all occupations.

As will be observed from Table 22, employer size would appear to exert the most consistent effect upon the level of education desired in employees, with the larger employers requesting higher levels of achievement. For the first group of 10 occupations, experience, wages, and industry also show a fairly consistent effect upon educational levels desired by employers. Viewing the 30 jobs together, however, the influence of experience upon education becomes cloudy.

Since there was undoubtedly some bias introduced into the computations - due to the need to eliminate all data cards which did not include information about education - the occupations, for which over 50 per cent of the cards received were unable, were examined as a set to see if there was any more consistent relationship among the signs of the coefficients for the variables than shown above. It was found that the distributions of signs were roughly the same as for the main group above; they

TABLE 22
SIGNS OF COEFFICIENTS OF INDEPENDENT VARIABLES

Variable	Signs of Coefficients			
	For the 10 Occupations where Multiple R was Significant		For All 30 Occupations	
	+	−	+	−
X_1 Region of Canada	5	5	17	13
X_2 Size of urban centre	3	7	11	19
X_3 Employer size	10	0	23	7
X_4 Experience wanted	1	9	14	16
X_5 Industry	8	2	18	12
X_6 Wages offered	8	2	21	9

Source: Appendix 3, Table B.

were certainly no more consistent. This implies, in a crude way, that differences in the proportions of usable cards were not responsible for the lack of complete uniformity in signs.

In order to decide whether an increased number of total usable observations had any effect upon results, the signs of the variables' coefficients for those five occupations which had over 135 observations were considered separately. Once again, very little improvement was noted in the consistency of these signs.

The signs for the largest single group of occupations - clerical - were also examined but, in this instance too, the variation in coefficients was much as indicated above.

As an alternative step, taken in an effort to improve the multiple correlation coefficients and the number of significant coefficients, educational level was converted into dummy variable

form. The assumption was that, in the above regression, perhaps too fine a categorization of educational requirements was being used. On a trial basis, four occupations were chosen and the following division of educational attainments employed:

Stock clerk: Y = 0 if education requested is for Grade 8, 9, or 10.
= 1 if for Grade 11, 12, 13, or 14.

Typist: Y = 0 if education requested is for Grade 9 or 10.
= 1 if for Grade 11, 12, or 13.

Routeman: Y = 0 if education requested is up to and including Grade 9.
= 1 if for Grade 10, 11, or 12.

Truck driver: Y = 0 if education requested is for Grade 5, 6, or 7.
= 1 if education is for Grade 8 to 12.

In the earlier regressions, these four occupations had multiple correlation coefficients not significant even at the 5 per cent level. As a result of handling educational level as a dummy variable, the multiple R's were in two cases raised very slightly - but not enough to make them significant at the 5 per cent level - whereas in the other two situations, the R's were lowered by similar rather minuscule amounts.[24] In view of this lack of improvement in the explanatory power of the regression equation, no further testing along these particular lines seemed to be warranted.

Taking the opposite position that a finer breakdown of variables might increase multiple correlation coefficients and the number which were significant, education was restored to its original quantitative form, and the following independent dummy variables were defined.

Variable	Value	Interpretation
X_1 =	0	Not in Newfoundland, New Brunswick, or Quebec (where average education level of the labour force is 8.7 years).
=	1	In one of these three provinces.
X_2 =	0	Not in Nova Scotia, Ontario, Manitoba, Saskatchewan, or Alberta (where average education level of the labour force is 9.4 years).
=	1	In one of these five provinces.

Variable	Value	Interpretation
		If X_1 and X_2 are both zero, the implication is that the observation is in British Columbia where the average education of the labour force is 10.2 years.
X_3 =	0	Employer does not employ less than 10 employees.
=	1	Employer has less than 10 employees.
X_4 =	0	Employer does not employ between 10 and 74 employees.
=	1	Employer has between 10 and 74 employees.
X_5 =	0	Employer does not have between 75 and 299 employees.
=	1	Employer has between 75 and 299 employees.
		If X_3, X_4, or X_5 are all zero, it implies that the employer has 300 or more employees.
X_6 =	0	Not in urban centre less than 15,000 population.
=	1	In urban centre less than 15,000.
X_7 =	0	Not in urban centre from 15,000 to less than 100,000.
=	1	In urban centre of from 15,000 to 100,000.
		If X_6 and X_7 are both zero, it implies that the observation is in a city greater than 100,000.
X_8 =	0	Not in primary or manufacturing industries.
=	1	In one of these two industries.
X_9 =	0	Not in the construction, transportation, or public utilities industries.
=	1	In one of these industries.
X_{10} =	0	Not in the trade or finance industries.
=	1	In one of these two industries.
		If X_8, X_9, or X_{10} are all zero, it implies that the observation is in the service industries.
X_{11} =	0	No experience required.
=	1	Experienced required.
X_{12} =		Wages, a quantitative variable taking on the observed value.

Once again, no interaction effects are considered in this format for reasons discussed earlier. Multiple regressions were run on four occupations - stock clerk, typist, truck driver, and stenographer.[25] Although the multiple regression coefficients rose slightly for all four occupations, the R's for the first three remained insignificant. For stenographers the level of significance dropped slightly. Moreover, there was no consistent relationship among the signs of the coefficients of the individual variables. Consequently, within the scope of this format, no other regressions were run. In short, it appeared no other reasonable combination of occupations nor breakdown of dependent and independent variables would provide greater uniformity of results among occupations higher multiple regression coefficients, or more significant coefficients of the individual independent variables, than the original simplified system of variables.

Thus, the original regressions on the 30 occupations were again considered. To measure the significance of the various individual coefficients over all 30 regression runs, the following statistic was calculated:[26]

$$Z_i = \frac{\sum_{j=1}^{30} W_{ij}\,\beta_{ij}}{\sum_{j=1}^{30} W_{ij}} \quad ; \quad i = 1 \text{ to } 6, \quad j = 1 \text{ to } 30$$

Where

β_{ij} = Beta-coefficient for the i^{th} variable and the j^{th} occupation.

W_{ij} = $\frac{1}{\sigma_{\beta ij}}$, where σ_β the standard error of the Beta-coefficient for the i^{th} variable and the j^{th} occupation.

The use of Beta-coefficients eliminates the effect of scale. The importance of using $\frac{1}{\sigma_\beta}$ as the weight is that the more significant coefficients are assigned a greater weight. The rationale of such a statistic is that, while for individual occupations the coefficients of variables may not be significant, if over all 30 jobs a particular positive or negative relationship between an independent variable and education is significant, the results become meaningful. In other words, significance tests for individual regression coefficients do not reflect the significance of patterns found for that coefficient over many regressions. The significance of such patterns is

tested by the Z statistic. The level of significance of Z, using 29 degrees of freedom with a two-tailed T-test are reported in Table 23.

TABLE 23
RESULTS OF TESTING THE SIGNIFICANCE OF Z_i

Variable	$\frac{Z_i}{\sigma Z_i}$ (1)	Level of Significance
X_1 Region of Canada	.5725	.6
X_2 Size of urban centre	-4.4725	.001
X_3 Employer size	4.6473	.001
X_4 Experience wanted	-3.2703	.01
X_5 Industry	1.0836	.3
X_6 Wages offered	6.1786	.001

Source: Appendix 3, Table B.

Note: (1)

$$Z_i = \frac{\sum_{j=1}^{30} W_{ij}\,\beta_{ij}}{\sum_{j=1}^{30} W_{ij}}; \quad i = 1 \text{ to } 6 \text{ (no. of variables)}$$

$j = 1$ to 30 (no. of occupations)

$$\text{Variance } Z_i = \frac{1}{\sum_{j=1}^{30} W_{ij}^2} \cdot \sum_{j=1}^{30} W_{ij}^2 \text{ Var. } \beta_{ij}$$

$$\text{and since } W_{ij}^2 = \frac{1}{\sigma\beta_{ij}^2} \text{ or } W_{ij}^2 \cdot \sigma\beta_{ij}^2 = 1$$

$$\sum_{j=1}^{30} W_{ij}^2 \,\sigma\beta_{ij} = N$$

$$\therefore \text{Var. } Z_i = \frac{N}{\sum_{j=1}^{30} W_{ij}^2}$$

and on the null hypothesis the β coefficients for the same variable in different regressions are independently distributed, the asymptotic distribution of Z will be normal. It is thus appropriate to test the null hypothesis using Student's T with $T = \frac{Z_i}{\sigma Z_i}$

Interpretation of Results

Taking the variables in the following order, the meaning of the results can be outlined:

X_1: Region of Canada. There appears to be no significant relationship between the region of Canada (and hence the level of education prevailing in that region) and the level of education which employers specify for particular occupations. In other words, there is no evidence from this portion of the study that employers in the west requested, with any degree of consistency, greater amounts of schooling in job applicants simply because the level of education of the labour force was higher in this area. Or alternatively, there is no indication that in the east, where the average level of education of the labour force was lower, employers lowered their demands according to the calibre of potential employees available.[27]

X_2: Size of urban centre. The significant negative relationship between size of city and education shown in Table 23 suggests that employers in smaller centres demand more education among prospective workers than do their counterparts in larger metropolitan areas. This runs counter to the proposal that employers may regularly demand higher education levels in those centres where the average level of education is greater, namely, in the larger cities. In other words, the evidence that this variable provides agrees with that suggested above by the lack of any significant relationship between education levels in regions of Canada and educational levels requested by employers.

There is a problem, however, of explaining why employers in smaller centres should request higher education levels. One possibility is that, in the larger cities, the firms requesting higher standards may be able to recruit their personnel directly (i.e., without going through the National Employment Service) either because of their reputation among prospective applicants or by advertising in newspapers. Another conceivable explanation is that there may be less unemployment among individual occupations in metropolitan centres so that employers are less particular about the educational qualifications. In the smaller cities unemployment may be greater, and employers are able to skim off the best applicants available. There is not sufficient data available to test either of these possibilities. At most, all that can be said for any tendency, which may exist on the part of employers to ask for greater education where levels of schooling of workers are higher, is that it must be so weak as to be overridden by these other influences working in the opposite direction.

X_6: Wages offered. The positive and very significant relationship between the level of schooling that employers request and the wages they are willing to offer may be indicative of one of three things: (1) that employers believe the better-educated employees are more productive; (2) that the businessmen do not believe that the better-educated are any more productive but nevertheless are willing to recruit them and pay them additional income for purposes such as prestige alone; in this case they would be non-profit-maximizers; or (3) that employers request more education and pay higher wages because they anticipate a growing need for more highly educated employees in the future. In this latter case, they could treat the increase in wage bill as a form of insurance premium paid to ensure they have employees on hand who can cope with technological change. The second possibility, that businessmen are non-profit-maximizers, seems unlikely in that the majority of employers in 21 out of 30 occupations (see Table 22) offered higher wages in return for better-educated employees. It is doubtful that such a large proportion of them would be non-profit-maximizers. If one were to accept this assumption, economists should begin altering their views about the profit goal of businessmen. The third alternative deserves greater consideration, but in view of the fact that 15 out of the 30 occupations are of a clerical nature (many of them identified with women's work) there is some doubt that protection against future technological change would be foremost in employers' minds in their hiring policies. Consequently, it is suggested that the first explanation - that better-educated workers are generally hired because they are thought to be more productive - should be favoured.

This interpretation also fits in with the evidence suggested from examination of variables X_1 and X_2 - that employers do not request higher education among new employees in some instances merely because it is available.

The conclusion to be drawn from consideration of the results on the variables above is that employers' requests for certain levels of education among new recruits - as revealed through the order cards filed with the National Employment Service - are a fairly accurate indication of the educational needs involved in particular occupations throughout the economy. Therefore, although most persons working in employment offices can undoubtedly quote instances of where employers do request more education in job applicants than they actually require, the evidence from this study indicates that these situations tend to be the exceptions rather than the rule.[28]

X_3: Employer size. Larger employers prefer better-educated employees, presumably, as suggested, for purposes of promotion and greater flexibility in the selective usage of employees.

X_4: Experience wanted. As anticipated, where employers specified that they wished experienced personnel, they were willing to accept lower levels of schooling. This relationship is indicated by the significant, negative Z statistic for this variable. The apparently rational behaviour of employers with respect to variables 3 and 4 provides a hint of support to the conclusion (suggested above) that employers are rational and ask for the educational levels they believe they require - not simply for what they think may be available.

X_5: Industry. There appears to be no significant relationship between industry and educational levels requested in particular occupations. As indicated earlier, this may be due to the fact that there is little difference between the nature of the educational requirements necessary in various industries, at least in the occupations used in this study.

The following section contains a comparison of employers' educational requirements with the 1961 Census educational levels, as well as the estimates based upon the Estimates of Worker Trait Requirements for 4,000 Jobs.

Relation of Employer Order Cards to 1961 Census Data and to Worker Trait Requirement Education Estimates

Employers' Requests and the 1961 Census Data. The average levels and ranges of education requested by employers for the various occupations are presented in Table 24. The years of schooling obtained from applying the GED estimates, as well as those of the relevant occupational group from the 1961 Census are also indicated.

In relatively few cases (eight) did the average educational levels requested by employers differ by more than one year from the averages for similar occupational groups in the 1961 Census. In seven of these, employers' requests were higher. Of these seven, four were professional or managerial occupations where the trend towards a university degree as a necessary qualification was clearly in evidence.

TABLE 24
COMPARISON OF EDUCATIONAL LEVELS FROM EMPLOYER ORDER CARD SURVEY, GED ESTIMATES, AND 1961 CANADIAN CENSUS

Dictionary of Occupational Titles Code Numbers	Occupational Title[2]	Employers' Requests		Education of Corresponding Census Groups	Education Using GED Estimates
		Range of Education[1] (Years)	Mean Education (Years)		
001.200	Accountant	12-17	15.6	13.4	16.0
016.010	Civil engineer	13-16	15.2	15.5	17.5
048.000	Draftsman	11-16	12.5	12.1	12.0
050.220	Chemist assistant	10-16	13.2	11.7	16.0
097.140	Junior executive	11-16	15.3	12.4	16.0
097.120	Office manager	11-16	13.4	11.8	16.0
	039.830 Personnel manager				19.0
	097.510 Production manager				19.0
	097.610 Sales manager				16.0
101.020	Bookkeeper	10-16	11.4	11.0	12.0
101.310	Accounting clerk	9-16	11.3		9.0
101.520	Cashier I	8-12	10.5		12.0
102.010	Bookkeeping machine operator I	10-13	10.8	10.8	9.0
	102.020 Bookkeeping machine operator II				9.0
	102.030 Machine operator III				7.0
105.010	Clerk general office	8-14	10.9	10.7	9.0
106.020	Teller	10-13	11.1	10.7	9.0
117.010	File clerk I	9-13	10.5		12.0
117.020	File clerk II	9-12	10.7		12.0
	117.030 File clerk III				12.0
118.430	Receptionist	8-12	10.6	10.7	9.0
125.620	Key punch operator	10-13	11.1	10.8	9.0
134.140	Shipping clerk	8-12	10.1	8.8	9.0
137.120	Stenographer	8-12	11.2	11.6	9.0
137.320	Typist	9-13	11.0	10.9	9.0

TABLE 24 (Concluded)

Dictionary of Occupational Titles Code Numbers	Occupational Title[2]	Employers' Requests		Education of Corresponding Census Groups	Education Using GED Estimates
		Range of Education[1] (Years)	Mean Education (Years)		
138.010	Stock clerk	8-14	10.6	9.4	9.0
142.310	Telephone operator				
	142.010 Central office operator	9-12	10.0	10.1	9.0
	142.050 Information operator				9.0
					9.0
155.200	Telephone solicitor	8-12	10.1	9.6	9.0
157.100	Insurance salesman	9-16	11.5	11.4	16.0
175.440	Salesperson, furniture				12.0
	185.310 Salesperson, chemicals and drugs	8-16	12.5	11.0	12.0
	186.120 Salesperson, office machinery				12.0
261.030	Watchman	7- 9	7.8	7.6	8.0
475.010	Machinist	8-12	8.6	9.0	12.0
480.010	Sheet metal worker	8-12	8.4	8.5	9.0
485.040	Welder	8-10	8.1	8.1	9.0
497.010	Electrician	8-12	8.6	9.5	12.0
524.010	Bricklayer	5- 8	7.5	7.3	12.0
688.622	Punch press operator	0- 8	5.7	8.0	7.0
735.100	Routeman	5-12	8.9	9.6	9.0
736.250	Truck driver, heavy	5-12	7.4	7.6	9.0
833.100	Labourer	5-10	8.0	7.2	7.0
949.220	Truck driver, helper	5- 8	7.1	7.1	7.0
988.400	Labourer, stores	5-13	8.4	8.3	7.0

Notes: [1] The ranges of education requested by employers vary from 3 to 8 years. Such differences may in part be due to variations in the individual tasks that persons in any one occupation have to perform. For example, a clerk, general office, may have widely different duties and responsibilities from firm to firm. Also, some of the DOT numbers included not only the workers but also the supervisor for that particular job, so there are bound to be variations depending upon whether a firm is recruiting a junior or senior staff member of that particular occupational title.

[2] Wherever occupations have been grouped, this has been done in order to have sufficient observations to run regressions.

The close correspondence between the average educational levels from employers' orders and the 1961 Census may indicate either that, with the exception of the professional and managerial occupations, the 1961 Census levels of education for the occupations examined in this study were near to being the ones required for production purposes, or that employers were gearing their demands to what they knew was available. That is, employers were (1) accepting people with lower levels of schooling than desired because no better-educated personnel were available or (2) they were taking more highly educated people than required because it was possible to obtain them.

The analysis of the preceding section, however, did not support the view that employers base their requests for education primarily upon the availability of personnel. Rather, all indications were that employers set their standards according to the needs of the job. One must therefore conclude that, apart from the professional and managerial occupations, the average schooling attainments of labour force participants, in 1961, in those jobs or groups of jobs examined in the present study, were generally adequate.

Employers' Requirements and GED Estimates. The conclusions regarding the accuracy of educational requirements specified on employer order cards in turn make it possible to evaluate the accuracy of the estimates of schooling requirements for particular jobs obtained from use of the GED levels. When the estimates are compared, the GED figures in 12 instances are one year or more above mean employers' requests, and in 15 instances they are at least one year lower. Even allowing for some errors in the averages obtained from the employer order cards due to the samples being small in several cases, a total of 27 differences of this magnitude out of 37 occupations is a high number. A few discrepancies stand out particularly, as for example: the Estimates of Worker Trait Requirements for 4,000 Jobs specifies a GED level of 5 for bricklayers and machinists which, when converted into an educational level is Grade 12. Yet for typists and stenographers the GED level is 4 which is roughly equivalent to Grade 9. Therefore, one has a situation where people working with the language and possibly doing arithmetical tabulations are supposed to require a lower level of educational development than men working primarily with their hands. Consequently, in determining educational levels for individual occupations, the data provided in the Estimates of Worker Trait Requirements for 4,000 Jobs and equated to standards of schooling in Canada appears to be unsatisfactory.

If, however, each of the major occupational groups is taken as a unit (clerical, sales, labourers, and so on), it becomes evident that the over- or underestimates of educational requirements from the GED levels begin to cancel one another out. For example, while typists and stenographers at a Grade 9 level appear to be low, file clerks with Grade 12 certainly seem on the high side. Similar situations occur also with the other occupational groups. Furthermore, an examination of the ranges of educational requirements obtained from the employers' requests, indicates the GED estimates fall within these ranges in all but 8 cases. It appears, then, that while the GED estimates are not suitable for determining precisely the educational requirements of individual occupations, they are suitable for indicating broad education needs for the major occupational categories. By comparing them with Census data - as was done earlier in this study - it is possible from such broad specifications to obtain a fairly clear picture of the main occupations which necessitate immediate attention, so that a system of priorities for education expenditures may be set up.

General Evaluation of the Usefulness of Employers' Order Cards. Although the use of GED levels has considerable value in determining educational requirements over broad occupational groups, employers' order cards, on the whole, appear to be a superior source of information on job educational needs. They provide data not only for broad occupational groups but also for individual jobs.

It should be emphasized, however, that this investigation of employers' requests involved a sample limited both in the number of occupations covered and, apart from a few cases, in the number of observations on any one occupation. Research covering more occupations and involving more observations, and several different months would be necessary before conclusive results are possible. Examining employers' requests for different months would make it possible to determine whether or not employers raise their educational standards for particular jobs at certain times of the year (i.e., in April and May when many university students are looking for work or in June and July when high-school students also join the labour force) and subsequently lower them again (i.e., when the school term starts in the fall).

With many more observations, interaction effects among variables could be investigated through the use of additional dummy variables in multiple regression analysis (or through the use of variance analysis). If education were also used as a dummy variable, it would be possible to interpret the resulting value of education (Y) in any one instance as an estimate of the conditional

probability of Y given the X's. From this, prediction equations might be developed for the amount of education required under various circumstances.[29] Other adaptations and improvements could undoubtedly be made if the occupational coverage of these order cards were to be augmented, and the detail reported on them were to be increased.

Consequently, if subsequent research supports the conclusions of the current study that, on the whole, employers are setting their educational standards according to the requirements of the job and not according to the availability of educated people, then these employer order cards will be of great use in future manpower planning.[30]

There are, however, two prerequisites for the success of any such program. First, surveys would have to be conducted on a periodic - not a once-for-all-time - basis if the data are to be kept up-to-date. Second, the National Employment Service would have to be used by more employers for more occupations if the results obtained are going to be both representative and comprehensive. Failure to achieve the co-operation of more employers in this project could spell failure for the project itself.

The Swedish Approach. In conclusion it might be noted that a somewhat similar approach to the use of the employer order cards is currently being carried out in Sweden.[31] There, the National Labour Market Board is circulating questionnaires to determine the amount and type of education and training necessary for members of the labour force to perform their different jobs. At the same time, an educational classification system is being developed. It involves ten major groups such as general education without vocational education or training, the sciences and technical education, and social science and commercial education. These groups each have subdivisions for technical and university education, and for the different areas of study such as physics, medical sciences, and psychology. Educational patterns for each occupation are considered separately for different industrial sectors because educational requirements vary to some extent from one sector to another, even within individual occupations. The final product of these endeavours will be a complete record of the educational requirements of the labour force and the patterns of schooling needed to produce people with these requirements.

This approach may be one that Canada may eventually wish to follow. It is much more thorough in its conception and coverage than anything suggested in the present analysis although, as far as is known, it does not as yet provide for continuous

updating of the information on educational requirements of occupations such as is possible through the use of the employer order cards. In any event, it is a study that bears watching, and the lessons to be learned from it will be of great interest to all those active in this field of research.

Footnotes

[1]See Richard Eckaus, "Education and Economic Growth", Economics of Higher Education, ed. Selma J. Mushkin (Washington: U.S. Government Printing Office, 1962); also "Economic Criteria for Education and Training", Review of Economics and Statistics, 46 (May, 1964), pp. 181-190.

[2]Bureau of Employment Security, U.S. Employment Service.

[3]Eckaus calculated education and training times by industry branches thereby arriving at the percentages of the labour force in each industry classification requiring different levels of general education and specific training.

[4]Estimates for Worker Trait Requirements for 4,000 jobs, p. 111.

[5]The Education Division of the Dominion Bureau of Statistics and The Canadian Education Association, Toronto, Ontario. Both authorities were well aware of the difficulties of making such classifications. Some differences exist among the individual provinces, but these are only one year at the most and have been allowed for in the above estimates by averaging where necessary.

[6]This figure is higher than the 7.4 per cent which Eckaus obtained for the United States labour force. There are several possible reasons for this. The most obvious one is that Eckaus's results are for 1951, whereas the present study refers to 1961. As other studies have indicated (e.g., Canada, Department of Labour, Economics and Research Branch, Occupational Trends in Canada: 1931 to 1961 (Ottawa: Queen's Printer, 1963), there has been a substantial increase in the past decade in the professional and managerial groups – where the demand for university education is by far the greatest. Secondly, GED level No. 7 in Eckaus's study was taken as equivalent to 18 years of schooling, whereas we used 19 years. Thus in determining the education level required for occupational groups where it was necessary to take an average of several individual occupations, the present figures would tend to be higher than those of Eckaus. More important, however, is that the American Census employs not much more than 100 occupational categories, whereas the Canadian Census used close to 300; thus a more detailed analysis of occupations was possible for Canada. Some elaboration of this point is necessary: in the United States study, since occupational groups were fewer and therefore wider, there is a good chance that the average education requirement for groups requiring university education, such as the professional and technical occupations, would be lower due to the inclusion of other lower-level occupations in this broad category. For example, even in the Canadian study, if, instead of calculating the percentage who required university by examining each of nearly 300 occupational categories, one had looked only at the averages for the 51 major subdivisions, the percentage of workers that would have been shown as requiring university would have been only 6.6 per cent, i.e., slightly below the 1950 results for the United States!

[7]It is still debatable whether technological change in every case actually raises the average training and educational requirements of the labour force; see Harry Brill, "Educating Youth: The Cruel Solution", The Nation (New York), March 23, 1964, Vol. 198, No. 13, p. 296. For an example on the other side of the argument see Samuel E. Hill and Frederick Harbison, Manpower and Innovation in American Industry (Princeton: Princeton University Industrial Relations Section, 1959).

[8]When women are considered as well, the percentage of workers requiring full high school is 26.3. The corresponding American figure is 25.0 per cent. Thus, once again, the Canadian results are higher though by not as much as for university people. As in the case of university-educated persons, we believe the main difference is probably due to the less detailed occupational classification for United States; see footnote 6.

[9]Clarence Long, The Labor Force Under Changing Income and Employment, National Bureau of Economic Research (Princeton: Princeton University Press, 1958), p. 31.

[10]Ibid., pp. 31-32.

[11]See Table 15, note 2; also Table 17, note 1.

[12]The corresponding figures from Eckaus's study for the United States is 1.35 years. See footnote 6 for a discussion of the possible reasons for this difference.

[13]Paper presented at the Meeting of an Ad Hoc Group on The Utilization and Education of Professional Engineers (OECD, Directorate for Scientific Affairs, Paris, November 4-6, 1963), in discussion of Point 4 of the Agenda, "Pedagogic Problems – Optimum Balance between Basic Studies and Post-graduate Training in an Economy on the Move".

[14]See Appendix to Chapter 3 for a copy of the Employer's Order Card used in the survey.

[15]For details of the process of selecting occupations see the author's doctoral dissertation: Some Economic Aspects of Education in Canada (Department of Economics, Massachusetts Institute of Technology, 1964).

[16]For a detailed list of all occupations included in the survey see Appendix to Chapter 3, Table A.

[17]Many cards had only such terms as "fair", "good", "suitable", or "open" shown in the space for educational requirement. Such terms, while vague to the researcher, frequently have a very definite meaning to both the employer and employment officer. However, it is difficult to know whether, on such cards, the employers' educational requirements would be higher or lower than the averages derived from the cards where education is stated precisely. Consequently, no attempt is made in this paper to suggest that those cards, where education is not specified, would disclose a bias one way or the other.

[18]This technique is discussed in J. Johnston, Econometric Methods (New York: McGraw-Hill, 1963); also in D.B. Suits, "Use of Dummy Variables in Regression Equations," Journal of the American Statistical Association, 52 (1957), pp. 548-551.

[19]These averages were computed using the same method discussed earlier in this chapter, and Census of Canada, 1961: Vol. 3, Part 1: Labour Force: Occupations by Sex, Showing Age, Marital Status and Schooling: Atlantic Provinces, Quebec, and Ontario, and Western Provinces.

[20]While there are no figures available for the average education of the labour force in each urban centre, it has been possible to calculate the average education for the population not in school and yet with more than kindergarten training. While this figure is well above the labour force population (11.6 million as opposed to 6.5 million in the labour force), it is used for lack of a better guide as an indication of the education level of the labour force. For Canada in 1961 the average education level for big cities of 100,000 and over was 9.43 years, whereas for smaller centres it was 8.87; DBS, 1961 Census of Canada: Vol. 1, Part II: Population, School Attendance and Schooling, Table 73, p. 2.

[21]DBS, Education Division, University Student Expenditure and the Income in Canada, 1961-62, Part II: Canadian Undergraduate Students (Ottawa: Queen's Printer, 1963), p. 22.

[22]It was suggested in an earlier chapter (p. 21) that workers are frequently not paid their marginal product. However, in this study, departures of remuneration paid from marginal productivity are likely to be either minor or in the same direction for any one occupation, so that a relationship between education, productivity, and wages offered should still show up. For example, most of the occupations examined are non-unionized, so that differences in bargaining power should not distort the wage structure. Furthermore, since consideration is only of one occupation at a time, non-pecuniary advantages and disadvantages will not distort the relationships since such influences will be roughly the same for all observations in any one occupation. The same is true for tradition-bound status differences causing wage distortions.

[23]As Table 18 indicated, professional occupations are also growing rapidly. However these comprise a relatively small proportion of total employees in any one organization.

[24]See Appendix 3, Table C, for multiple regression coefficients on these runs and those immediately following.

[25]Stenographer was substituted for routeman because the former had more observations (290 as opposed to 43 for routeman), and additional observations were required in this situation because of the increased number of variables.

[26]I am indebted to Professor Franklin M. Fisher of the Massachusetts Institute of Technology for suggesting this test.

[27]Another possibility is that perhaps because higher unemployment rates existed in the Maritimes and Quebec compared with western Canada, employers were able to be more selective in the eastern region and maintained higher educational standards than they otherwise would have done, given the lower educational levels prevailing in their area. However, if unemployment rates had greatly influenced employers' educational standards for hiring, one would have expected that when British Columbia was taken as a separate region there would have been clear evidence of higher educational levels being requested by employers in that province than in the other regions. Not only was the educational achievement of the labour force higher there but unemployment was greater than the national average. However, the results did not indicate that employers in British Columbia were setting any higher educational levels than employers in other provinces. Hence, it must be concluded that different unemployment rates in different regions do not appear to account for the fact there were no consistent, significant relationships between region of the country (and the educational level prevailing in that region) and educational requirements of employers. An additional factor which might be mentioned as tending to equalize employers' demands for education throughout the country, regardless of the average educational level prevailing in each region, is that some large employers hire all across Canada and have uniform educational requirements. However, the number of such employers is relatively small. Furthermore, cross-country recruiting policies hold true primarily for the professional and managerial categories. Therefore this argument cannot explain the lack of consistent relationship between educational levels in each region and educational requirements of employers which prevailed for the other occupations as well.

[28]The only other possibility is that NES officers have been quite consistent across the country in the educational levels they have suggested employers might ask for in particular jobs. But if this is so, it again indicates that even among employment officers, there has been no clearly recognizable tendency to recommend widely different educational levels to employers in the different regions where years of schooling possessed by the labour force vary.

[29]Such techniques have already been used extensively by Guy H. Orcutt, Martin Greenberger, John Korbel, and Alice M. Rivlin, Microanalysis of Socieoconomic Systems: A Simulation Study (New York: Harper & Row, 1961), especially pp. 224 ff.

[30]It should be made clear that it is not suggested that these cards be used to determine the absolute number of vacancies for various types of occupations across the country (although they do give some guidance along these lines) but rather that they be utilized to obtain current estimates of the levels of education necessary for various occupations.

[31]Stan-Olof Döös, "Long-Term Employment Forecasting: Some Problems with Special Reference to Current Organization and Methods in Sweden," Employment Forecasting (Paris: OECD, 1962); also correspondence with G. Parago, Secretary, Methodological Working Group, National Labour Market Board.

Appendix to Chapter 2

TABLE A
EDUCATION COSTS, ELEMENTARY AND SECONDARY SCHOOLS, AND UNIVERSITY
(millions of dollars)

School Level	Gross Expenditures Out of Current Revenue (Public) (1)	Public Schools				Private Schools		Public and Private Schools		
		Capital Costs Out of Current Expenditures (2)	Net Current Expenditures (1)-(2) (3)	Implicit Interest and Depreciation (4)	Total Costs (Public Schools) (5)	Gross Expenditures (6)	Total Costs (Private) (7)	Total Costs (5)+(7) (8)	Elementary Schools (9)	Secondary Schools (10)
Elementary and Secondary	1,209	241	968	203	1,171	47	46	1,217	834	383
Higher Education	232	79	153	38	191	-	-	191	-	-

Sources:

Line (1): Column (1) Canada, Dominion Bureau of Statistics, Education Division, Preliminary Statistics of Education: 1961-1962 (Ottawa: Queen's Printer, 1962), Table 22.
Column (2) Capital costs were not available from the above source, but an examination of earlier years indicated that such costs regularly equalled about 20% of gross expenditures. Hence this figure has been used in computing capital costs.
Column (3) = Col. (1) - Col. (2).
Column (4) No Canadian figures were available on the value of property from which Implicit Interest and Depreciation might be calculated. Thus a figure of 21% of Net Expenditures has been used based on the fairly regular relationship which has existed between these two amounts in the United States as indicated by an examination of data presented by T.W. Schultz in "Capital Formation by Education," Table 3, Col. (3) and (5).
Column (5) = Col. (3) + Col. (4).
Column (6) Same as Col. (1).
Column (7) On the assumption that capital expenditures, implicit interest and depreciation charges bear the same relationship to gross expenditures as for public schools, this figure has been computed by using the ratio of $\frac{\text{Col. (5)}}{\text{Col. (1)}}$ x Col. (6).
Column (8) = Col. (5) + Col. (7).
Column (9) Computations are as follows:

	Elementary	Secondary
Pupil-teacher ratio	26	19

(Developed from data in Preliminary Statistics of Education, 1961-1962 Table 2). The salaries of teachers of secondary subjects are roughly 50% above those of primary teachers throughout Canada, Ibid., Table 7, or a 150/100 ratio. Thus, $\frac{150/19}{100/26} = 2.05$;
that is, it costs over twice as much per student in secondary grades as in primary grades. Using this information and the enrollments of primary and secondary pupils for the 1959-1960 academic year, it was calculated that 68.5% of total costs should be applied to secondary schools; thus 68.5 x 1217 = $834.
Column (10) = Col. (3) - Col. (9).

Line (2): Column (1), (2) and (3) Dominion Bureau of Statistics, Education Division, Survey of Education Finance: 1959-1960, (Ottawa: Queen's Printer, 1963), Table 75. These figures exclude such items as scholarships, expenditures on defence colleges, education of veterans, and research costs.
Column (4) Again no Canadian figures are available for the value of property held. A figure of 25% of Net Expenditures has been used for Implicit Interest and Depreciation, based on data presented by T.W. Schultz in "Capital Formation...", Table 22.
Column (5) = Col. (3) + Col. (4).

TABLE B

COSTS PER OCCUPATION OF CANADIAN-BORN EMIGRANTS TO THE UNITED STATES AND IMMIGRANTS TO CANADA 1951-1961[1]

Canadian-Born Emigrants to United States	Costs Per Person Times Years of Schooling (dollars)				Total Cost Per Occupation
	Elementary	High School	University	Vocational Training	
	(1)	(2)	(3)	(4)	(5)
Managers, officials and proprietors	2,024	3,408	-	12,750	18,182
Professional, technical and kindred workers	2,024	5,680	5,186	8,925	21,815
Clerical and kindred workers	2,024	3,976		1,530	7,530
Sales workers	2,024	2,840		1,275	6,139
Private household workers	2,024	142		1,020	3,186
Service workers except private household	2,024	1,136		1,275	4,435
Farmers and farm managers	2,024	-		12,750	14,774
Farm labourers and foremen	1,872	-		510	2,382
Craftsmen, foremen and kindred workers	2,024	142		4,590	6,756
Operatives and kindred workers	1,973	-		1,785	3,758
Labourers except mine and farm	1,822	-		-	1,822
Housewives	2,024	2,556		2,805	7,385
Students[2]	2,024	5,680		-	7,704
Children	1,012	-		-	1,012
Others	2,024	3,124		4,590	9,738

TABLE B (Concluded)

Immigrants	Costs Per Person Times Years of Schooling (dollars)				Total Cost Per Occupation
	Elementary	High School	University	Vocational Training	
	(1)	(2)	(3)	(4)	(5)
Managerial	2,024	3,408	-	12,750	18,182
Professional	2,024	5,680	5,186	8,925	21,815
Clerical	2,024	3,976	-	1,530	7,530
Transportation and communication	2,024	994	-	1,020	4,038
Commercial and financial	2,024	2,982	-	1,530	6,536
Services	2,024	568	-	1,275	3,867
Agricultural	1,822	-	-	510	2,332
Fishing, trapping and logging	1,569	-	-	510	2,079
Mining	1,923	-	-	6,120	8,043
Manufacturing, mechanical and construction	2,024	-	-	4,845	6,869
Labourers	1,822	-	-	-	1,822
Others	2,024	994	-	3,060	6,078
Housewives	2,024	2,556	-	-	4,580
Children	1,012	-	-	-	1,012
Others	2,024	994	-	3,060	6,078

Sources: The costs of one year of each type of education as computed in Column (4) of Table 7 are multiplied by the years of education shown in Columns (2) and (3) of Tables 5 and 6. Elementary education is assumed to be up to and including Grade 8, secondary education covers Grades 9 to 12, and university education is beyond Grade 12. The results are shown in Columns (1) to (4). Column (5) is the total of the preceding columns.

Notes: [1] Some authors would consider the costs of migration as themselves a form of human capital investment, e.g., Larry A. Sjaastad, "The Costs and Returns of Human Migration", Journal of Political Economy, 70 (Supplement, October, 1962), pp. 80-93; but this possibility is being ignored in these calculations.

[2] Grade 12 is assumed.

Appendix to Chapter 3

Miscellaneous Material on Employer Order Card Survey

EMPLOYER ORDER CARD SURVEY - DIRECTIVE
UNEMPLOYMENT INSURANCE COMMISSION
OTTAWA, OCTOBER 1963

Employment Circular No. 371

Subject: Survey of Employer Requirements

1. The National Employment Service has agreed to provide data for a survey of employer requirements regarding certain occupations. The data will be obtained from a review of orders that were received by local offices during the month of November 1962.

2. On receipt of this circular LOs will draw from the dormant order file all regular orders received during November 1962 (i.e., those assigned order numbers in November 1962) with occupational codes listed on the attached sheet. Orders for casual workers will be excluded.

3. Each order will then be coded, in red, in the "Employer" box in the top left-hand corner, as follows:
    1. LO Number
    2. Employer Category
    3. The letter "A" or "B" or "C" depending on the urban population of the centre in which the LO is located based on the following:
        "A" Urban population of less than 15,000
        "B" Urban population of 15,000 to 100,000
        "C" Urban population of 100,000 or over.

    A dash will be entered between the codes. For example: 512-5-C would indicate an order from the Ottawa LO - from a category 5 employer - and the urban population is 100,000 or over.

4. The orders will then be sorted numerically by occupational code and the number of orders in each occupational code will be entered on the attached sheet. The sheet will be detached from the circular, parcelled with the orders (which will be retained in numerical code order) and sent to DBS at HO.

5. Orders taken during the month of November 1962 which are not forwarded to HO will, of course, be retained in the dormant file and disposed of in the usual way at the end of November 1963. The orders sent to HO will not be returned to LOs.

Laval Fortier,
Chief Commissioner.

Job Requirements

Employer			Occupation Required	Number Required	Occupational Code
Address		Telephone	Description of Duties		Order Unit Number
Apply to		When			
Nature of Business		Indicate Code			
	Yes	No	Name of Union		
Collective Bargaining Exists					
Must be a Union Member					
Must Join Union					
Experience-Education-Physical		Sex	Regular Salary or Wage Rate	Overtime Rate	Hours
		Vet	Days Per Week	When Paid	Duration
Other - (Tools, Equipment, Certificates or Licenses Required, Other Union Details, Marital Status, Board and Living Conditions, Transportation, Etc.)					
Repeat of Order Number	Repeated on Order Number		Order Received By	Date	Time

UIC733(6-60)	Unemployment Insurance Commission	EMPLOYER'S ORDER	731A	Order Register	753

TABLE A
OCCUPATIONS IN EMPLOYER ORDER CARD SURVEY AND NUMBERS RECEIVED

Occupational Code	Occupational Title	No. of Orders
0-01.20	ACCOUNTANT, GENERAL (profess. and kin.)	68
0-01.30	ACCOUNTANT, PUBLIC (profess. and kin.)	5
0-15.01	CHEMICAL ENGINEER (profess. and kin.)	15
0-16.01	CIVIL ENGINEER (profess. and kin.)	33
0-17.01	ELECTRICAL ENGINEER (profess. and kin.)	41
0-25.10	PHARMACIST (profess. and kin.)	7
0-27.20	CASE WORKER (profess. and kin.)	9
0-33.07	NURSE HEAD (medical ser.)	1
0-33.10	NURSE, GENERAL DUTY (medical ser.)	23
0-33.56	NURSE, STAFF, PUBLIC HEALTH (medical ser.)	-
0-39.83	MANAGER, PERSONNEL (any ind.) I	4
0-48.01	DETAILER (profess. and kin.)	12
0-48.05	DRAFTSMAN, ARCHITECTURAL (profess and kin.)	22
0-48.06	DRAFTSMAN, COMMERCIAL (profess. and kin.)	3
0-48.10	DRAFTSMAN, OIL AND GAS (petrol. production; petrol. refin.; pipe lines)	5
0-48.11	DRAFTSMAN, ELECTRICAL (profess. and kin.)	13
0-50.01	MEDICAL TECHNOLOGIST (medical ser.)	17
0-50.04	X-RAY TECHNICIAN (medical ser.)	7
0-50.22	CHEMIST, ASSISTANT (profess. and kin.)	37

TABLE A (Continued)

Occupational Code	Occupational Title	No. of Orders
0-50.40	X-RAY TECHNICIAN (any ind.)	1
0-68.505	PROJECT PLANNER, DATA PROCESSING SYSTEM (profess. and kin.)	2
0-69.21	RADIO ANNOUNCER (radio broad.)	1
0-69.981	PROGRAMMER (profess. and kin.)	3
0-69.985	SYSTEMS ANALYST (profess. and kin.)	2
0-72.02	MANAGER, RETAIL SHOE (ret. tr.)	1
0-72.21	MANAGER, RETAIL FOOD (ret. tr.)	2
0-72.51	MANAGER, RETAIL GENERAL MERCHANDISE (ret. tr.)	2
0-74.11	BUYER (ret. tr.; whole. tr.)	2
0-91.60	PURCHASING AGENT (any ind.)	1
0-97.12	MANAGER, OFFICE (any ind.)	16
0-97.14	JUNIOR EXECUTIVE (any ind.)	86
0-97.51	MANAGER, PRODUCTION (any ind.)	11
0-97.61	MANAGER, SALES (any ind.)	12
1-01.02	BOOKKEEPER (clerical) II	204
1-01.31	ACCOUNTING CLERK (clerical)	143
1-01.52	CASHIER (clerical) I	59
1-02.01	BOOKKEEPING MACHINE OPERATOR (clerical) I	42
1-02.02	BOOKKEEPING MACHINE OPERATOR (clerical) II	37
1-02.03	BOOKKEEPING MACHINE OPERATOR (clerical) III	16
1-02.04	POSTING MACHINE OPERATOR (clerical) II	12
1-05.01	CLERK, GENERAL OFFICE (clerical)	1,007

TABLE A (Continued)

Occupational Code	Occupational Title	No. of Orders
1-06.02	TELLER (banking)	72
1-17.01	FILE CLERK (clerical) I	88
1-17.02	FILE CLERK (clerical) II	33
1-17.03	FILE CLERK (clerical) III	8
1-18.43	RECEPTIONIST (clerical) I	83
1-25.62	KEY-PUNCH OPERATOR (clerical)	61
1-34.14	SHIPPING CLERK (clerical) II	104
1-37.12	STENOGRAPHER (clerical)	851
1-37.32	TYPIST (clerical)	407
1-38.01	STOCK CLERK (clerical)	321
1-42.01	CENTRAL OFFICE OPERATOR (tel. and tel.)	8
1-42.05	INFORMATION OPERATOR (tel. and tel.)	2
1-42.31	TELEPHONE OPERATOR (clerical) I	30
1-55.20	TELEPHONE SOLICITOR (any ind.)	42
1-57.10	SALESMAN, INSURANCE (insurance)	38
1-57.40	CLAIM ADJUSTER (insurance)	6
1-75.04	SALESPERSON, MEN'S AND BOYS' CLOTHING (ret.tr.; whole. tr.)	63
1-75.44	SALESPERSON, FURNITURE (ret. tr.; whole. tr.)	15
1-85.31	SALESMAN, CHEMICAL AND DRUG (whole. tr.)	14
1-86.12	SALESMAN, OFFICE MACHINERY (ret. tr.; whole. tr.)	24
2-33.20	NURSE, PRACTICAL (medical ser.)	69
2-61.03	WATCHMAN (any ind.) I	109
2-66.23	PATROLMAN (gov. ser.)	4

TABLE A (Concluded)

Occupational Code	Occupational Title	No. of Orders
4-75.010	MACHINIST (mach. shop)	155
4-80.010	SHEET-METAL WORKER (sheet metal)	92
4-85.040	WELDER, COMBINATION (any ind.)	223
4-97.010	ELECTRICIAN (any ind.)	240
5-24.010	BRICKLAYER (const.)	220
5-36.010	BUS DRIVER (motor trans.)	14
5-53.420	LINEMAN (light, heat and power)	18
6-30.070	POWER-SAWMAN (logging)	195
6-30.140	FALLER (logging)	29
6-36.050	FURNITURE ASSEMBLER (furn.)	11
6-86.110	DROP-HAMMER OPERATOR (forging) I	-
6-88.622	PUNCH-PRESS OPERATOR (any ind.) I	69
7-35.100	ROUTEMAN (any ind.)	220
7-36.250	TRUCK DRIVER, HEAVY (any ind.)	570
7-57.021	MARKER (clean., dye., and press.; laund.)	9
7-57.512	SHIRT PRESSER (laund.)	58
8-03.01	LABOURER (distilled liquors)	13
8-33.11	LABOURER (woodworking)	111
9-49.22	TRUCK-DRIVER-HELPER (any ind.)	94
9-57.21	LABOURER (any ind.)	104
9-88.40	LABOURER, STORES (any ind.)	924
	TOTAL	7,805

for _____
LOM

TABLE B
SUMMARY OF INFORMATION ON EMPLOYER ORDER CARDS

Dictionary of Occupational Titles Code Number	Occupational Title	Original Number of Observations	Number with both Education and Wages Shown	Per Cent (2) of (1)	Mean Education	Education of Corresponding Census Groups	Education Using GED Estimates	Range of Education (Years)	STD Deviation (Education)	Mean Wage (Dollars)	STD Deviation (Wages)	Multiple R	R^2	Signs of Coefficients 1 2 3 4 5 6
001.200	Accountant	68	43	63	15.6	13.4	16.0	12-17	.46	2.40	.89	.5577	.3110	- + - - - +
016.010	Civil Engineer	33	26	79	15.2	15.5	17.5	13-16	1.25	2.69	.69	Var. 3 Const.	-	
048.000	Draftsman	55	32	58	12.5	12.1	12.0	11-16	1.00	1.95	.52	.2313	.0535	+ - + + - +
050.220	Chemist Assistant	37	28	76	13.2	11.7	16.0	10-16	1.47	1.73	.43	.7368[1]	.5429	- + - + - +
097.140	Junior Executive	86	57	66	15.3	12.4	16.0	11-16	1.50	2.10	.40	.8329[2]	.6937	- + + + - +
097.120	Office Manager						16.0							
	039.830 Personnel Manager	43	21	68	13.4	11.8	19.0	11-16	2.01	2.87	.65	.8612[1]	.7417	- + - + - -
	097.510 Production Manager						19.0							
	097.610 Sales Manager						16.0							
101.020	Bookkeeper	204	42	21	11.4		12.0	10-16	1.09	1.47	.42	.3833	.1469	- - - + + -
101.310	Accounting Clerk	143	61	43	11.3	11.0	9.0	9-16	1.36	1.43	.31	.6809[2]	.4635	- + + - - +
101.520	Cashier I	59	16	27	10.5		12.0	8-12	1.12	1.03	.23	.8682[1]	.7538	+ + - + - +
102.010	Bookkeeping Machine Operator I	42	18	43	10.4		9.0	10-12	.75	1.44	.16	.7486	.5604	- - - - + -
	102.020 Bookkeeping Machine Operator II	53	27	51	11.2	10.8	9.0	10-12	.67	1.20	.20	.7017	.4924	+ + + + + -
	102.030 Machine Operator III						7.0	10-13						
105.010	Clerk- General Office	1,003	450	45	10.9	10.7	9.0	8-14	.97	1.14	.28	.3655[2]	.1336	+ + - - - +
106.020	Teller	72	44	61	11.1		9.0	10-13	.79	.97	.11	Var. 4 Const.	-	
117.010	File Clerk I	88	45	51	10.5	10.7	12.0	9-13	.91	1.02	.13	Var. 3 Const.	-	
117.020	File Clerk II	41	28	68	10.7		12.0	9-12	.80	1.02	.17	.7750[1]	.6006	+ + - + - +
	117.030 File Clerk III						12.0							
118.430	Receptionist	83	20	24	10.6	10.7	9.0	8-12	.97	.97	.23	.6863	.4710	+ + - - + -
125.620	Key Punch Operator	61	21	34	11.1	10.8	9.0	10-13	.99	1.23	.31	.5547	.3077	+ + - + + +
134.140	Shipping Clerk	104	30	29	10.1	8.8	9.0	8-12	.11	1.15	.29	.5992	.3590	+ + + + - +
137.120	Stenographer	854	290	34	11.2	11.6	9.0	8-12	.79	1.22	.28	.3278[1]	.1075	+ + - + - +
137.320	Typist	407	135	36	11.0	10.9	9.0	9-13	.95	1.14	.19	.3659	.1339	+ + - + + +
138.010	Stock Clerk	321	136	42	10.6	9.4	9.0	8-14	1.28	1.14	.32	.3125	.0977	+ + - + - +
142.310	Telephone Operator						9.0							
	142.010 Central Office Operator	40	18	45	10.0	10.1	9.0	9-12	1.00	.99	.25	.6200	.3844	+ + + - - +
	142.050 Information Operator						9.0							
155.200	Telephone Solicitor	42	21	50	10.1	9.6	9.0	8-12	1.17	.97	.19	.8016[1]	.6426	+ + + + - -
157.100	Insurance Salesman	38	21	55	11.5	11.4	16.0	9-16	1.37	.88	1.10	Var. 2, 4 Const.	-	
175.440	Salesman, Furniture						12.0							
	185.310 Salesman, Chemical and Drugs	53	21	40	12.5	11.0	12.0	8-16	1.86	1.80	.74	.6681	.4464	- - + - - +
	186.120 Salesman, Office Machines						12.0							
261.030	Watchman	109	17	16	7.8	7.6	8.0	7-9	.51	1.17	.42	.6602	.4359	+ - - - + +
475.010	Machinist	155	25	16	8.6	9.0	12.0	8-12	1.26	1.71	.34	.6285	.3950	+ + - + + -
480.010	Sheet Metal Worker	92	15	16	8.4	8.5	9.0	8-12	1.08	1.88	.28	.6401	.4097	- + - - + -
485.040	Welder	223	22	10	8.1	8.1	9.0	8-10	.44	2.05	.35	Var. 4, 5 Const.	-	
497.010	Electrician	240	14	6	8.6	9.5	12.0	8-12	1.05	2.22	.30	.8412	.7076	- + - - + +
524.010	Bricklayer	220	13	6	7.5	7.3	12.0	5-8	1.08	2.66	.36	Var. 5 Const.		
588.622	Punch Press Operator	69	18	26	5.7	8.0	7.0	0-8	3.54	1.48	.29	Var. 1, 3, 4, 5 Const.		
735.100	Routeman	221	43	19	8.9	9.6	9.0	5-12	1.15	1.26	.36	.5548	.3078	+ - + - - +
736.250	Truck Driver, Heavy	570	77	14	7.4	7.6	9.0	5-12	1.52	1.46	.34	.4268	.1822	- + - + + +
833.100	Labourer	111	13	12	8.0	7.2	7.0	5-10	1.04	1.06	.23	.4776	.2281	- + + - + +
949.220	Truck Driver Helper	94	14	15	7.1	7.1	7.0	5-8	1.25	.78	.30	.7401	.5477	- - + + + -
988.400	Labourer: Stores	924	260	28	8.4	8.3	7.0	5-13	1.98	1.14	.34	.3732[2]	.1393	- + - + + +
		7,058	2,182											

Notes: [1] Multiple R coefficient is significant at the 5 per cent level.
[2] Multiple R coefficient is significant at the 1 per cent level.

TABLE C
RESULTS OF MULTIPLE REGRESSIONS UNDER VARYING CATEGORIZATION OF VARIABLES

Occupation	Multiple R's with 6 Independent Variables and Education in Quantitative Form	Multiple R's with 6 Independent Variables and Education as a Dummy Variable	Multiple R's with 12 Independent Variables and Education in Quantitative Form
Stock Clerk	.3125	.2271	.4139
Typist	.3659	.3588	.4048
Routeman	.5548	.5764	-
Truck Driver	.4268	.4471	.4656
Stenographer	.3278	-	.3290

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